EV-S700ES/UB

AEP Model
(EV-S700ES)
UK Model
(EV-S700UB)

November, 1985

DAV Video 8

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8 VIDEO CASSETTE RECORDER

SONY®

Consumer VIDEO

SECTION 1
DESCRIPTION

This equipment is the first 8 mm VTR which incorporates the PCM stereo system, and is has the following features.

1 The PCM stereo function is mounted.
2 When used only as the audio source, it is possible to record 6 tracks for a total of 18 hours. (Multiple PCM function)
3 It covers all the functions necessary for the video deck such as clean still, slow, etc.
4 It is mounted with a program timer of 6 programs in 3 weeks.
5 Others

With ragard to the PCM stereo among the above, the large feature point is that audio dubbing is enabled compared to the Beta Hi-Fi. For example, various sounds can be inserted afterward to the picture taken outdoors.
In addition, as this model is equipped with 2 audio channels of FM audio (monaural) and PCM stereo, FM broadcasts can simultaneously be recorded in the PCM area while recording a TV program from the tuner, for example.
When using as a 6 track multi PCM, it is so composed that the video recording area can be switched to audio and divided into 5 sections, while the ordinary PCM audio section is in the original state, as shown in Fig. 1-10.
It is therefore possible to record for 9 hours in the SP mode (Use-P5-90 tape), and 18 hours in the LP mode. It is possible, at this time, to also record from 1 track to 6 tracks in sequence, or to perform recording at random.
We would like to complement on the AV timer function. For example, when a TV program is recorded by stereo and 3 programs are recorded, and it is desired that the third audio is recorded from another source, etc., program reservation can be made by specifying the input selection mode by program unit so that input can be performed from both the line and TV.

1-1. REGARDING THE FORMAT OF 8 mm VIDEO

1. Features of the 8mm video

The 8 mm video has the following features:
- Ultra miniaturization . . . Drum size (= miniaturization of overall mechanism), cassette size and tape width.
- Extended time . . . Metal tape and high density recording.
- Unified format . . . Cassette in common worldwide.
- Hi-Fi . . . AFM and PCM stereo.
- High dependability . . . Low tape tension and CTL trackless.
- Development capability into new features (Multi PCM, etc.)

Table 1-1. indicates the comparison of formats between the 8 mm video and the present video for home use.

	8mm video SP/LP	β system	VHS system
Tape width (mm)	8	12.65	12.65
Size of cassette (mm)	95×62.5×15	156×96×25	188×104×25
Head drum diameter (mm)	40	74.5	62
Tape forwarding velocity (mm/sec)	20.051/10.058	18.73	23.39
Relative velocity (m/sec)	3.12/3.13	5.832	4.85
Video signal recording system	2-head azimuth	2-head azimuth	2-head azimuth
Azimuth angle (degree)	±10	±7	±6
Y signal recording system	FM modulation recording	FM modulation recording	FM modulation recording
FM carrier wave frequency White peak (MHz) Synchronizing peak (MHz)	 5.4 4.2	 5.2 3.8	 4.8 3.8
Chroma signal recording system conversion frequency (kHz)	Low conversion system 732 (PS)	Low conversion system 685.547, 689.453 } 2 frequencies	Low conversion system 626.95 (PS)
Video track pitch (μm)	34.4/17.2	32.8	49
Overall video width (mm)	5.351	10.2	10.07
Video track center (mm)	4.461	6.01	6.2
Control track width (mm)	—	0.6	0.75
Audio signal recording system	FM recording (Standard equipment, 1 channel, frequency Multiplex recording with video signal. 1.5MHz) PCM recording (Option: approximately 30 degrees on the 2 channel extended video track) Fixed head recording (Option: 1 channel 0.6 mm width)	Fixed head recording (Track width 1.05 mm Stereo 0.35 mm × 2) β Hi-Fi recording (Stereo, Depth recording)	Fixed head recording (Track width 1.0 mm Stereo 0.35 mm × 2) VHS Hi-Fi recording (Stereo, Depth recording)

Table 1-1. Comparison between 8 mm video and the present home VTR (Beta, VHS) (PAL)

1-2. CASSETTE STRUCTURE

The external view of the structure of the cassette of 8 mm video is shown in Figs. 1-2 and 1-3. In addition, comparison of the size of cassettes classified by VTR types is indicated in table 1-2. The 8 mm video cassette seems as though it has been scaled down to the audio cassette size with structure similar to that of the Beta cassette. However, this cassette half is provided with various functions which are not limited to merely the presevation and protection of the tape. Its main features are as follows: follows:

1. There is no tape guide

As the support of the tape running system is almost entirely performed at the VTR side, the effect from the cassette is negligible and enables stable operation. Moreover, the cassette itself is simply structured and has high reliability.

Fig. 1-1. 8 mm video cassette. The lower is Betamax cassette.

2. Hermetically sealed casing (2 parts) tape protection

The tape casing which is pulled out consists of 2 parts superpositioned and the tape is inserted in between. Accordingly, the fingers do not touch the tape entirely in normal handling, and it is so structured as to be dust proof. When the casing is inserted into the VTR, the lock is released and the casing is opened.

3. Reel lock mechanism which prevents loose tape tension

The lower side of the 2 reels are gear-shaped and enables the reel stopper to be hooked to them. And each reel can be moved in the direction where the tape is taken up, but will not move in the direction which causes loose tape tension. Similar as in 2., the lock is released when the VTR is inserted.

4. Non-erasure claw

It is like a slide switch and does not suddenly move and can be repeatedly used.

5. Cassette mis-insertion prevention shape

Consideration has been given that it is so shaped that it cannot be inserted into the VTR top and bottom inversely or front and rear inversely, and thus protects the tape and mechanism.

6. Automatic discrimination mechanism of tape types, tape thickeness, etc.

With this mechanism, the switchover can be performed automatically in accordance with the operation which matches each tape, and there is no complicated operation such as tape selector switching, etc.

7. Optical system of tape end detection by the transparent leader

Enables optical system automatic stop, and does not render unnatural load to the tape end and mechanism.

8. Grip for automatic changer

It will be able to cope with, in the future, the merchandising of the convenient automatic changer to playback continuously with multiple cassettes, or when it is desirable to use different cassettes with different programs with the use of the timer recording, etc.
In addition to the above features, it is certainly a video tape with "cassette sensibilities" with features such as the wide, transparent window which enables easy confirmation of the amount of tape remaining, as also the handy to use transparent cassette case, etc.
Moreover, the indication of the model is made uniform so that the type of cassette tape and recording time may be recognized at a glance. (See Table 1-3.)

Types of cassette	Tape width (mm)	Width×height×depth (mm)	Volume ratio
8mm video (Video 8)	8	95 × 62.5 × 15	1
1/2 inch for home use (Betamax)	12.65	156 × 96 × 25	4.2
1/2 inch for home use (VHS)	12.6	188 × 104 × 25	5.5
3/4 inch for professional use (U-matic)	19.0	221 × 140 × 32	11.1
(Reference) Audio cassette	3.8	102 × 63 × 12	0.87

Table 1-2. Comparison of size of cassettes classified by VTR types (Maximum dimensions including protruding sections)

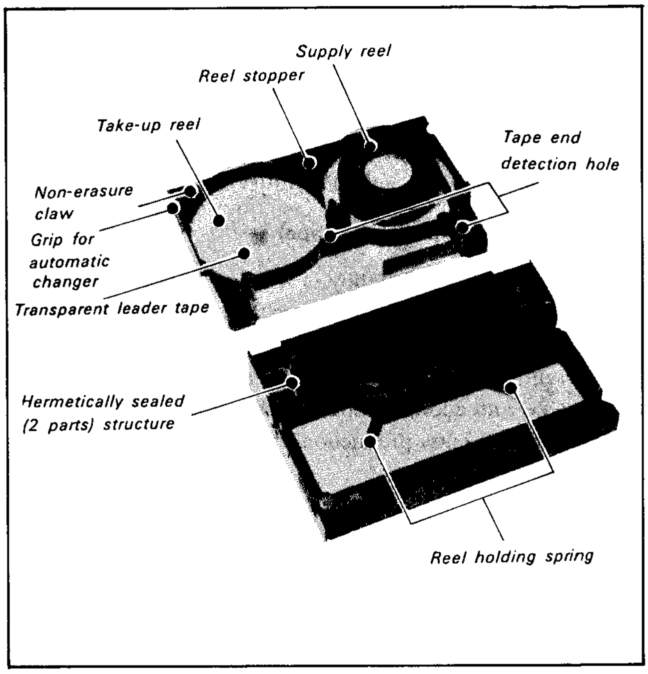


Fig. 1-2. Cassette structue (interior)

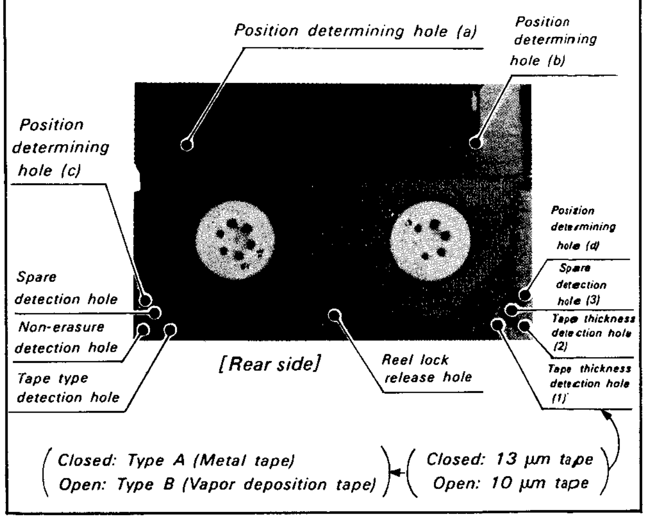


Fig. 1-3. Cassette structure (exterior)

Metal tape 90 minute recording with PAL

P5-90

- 90 — *Recording time at standard mode (Unit: minute)*
- 5 — *6: NTSC system (60 fields)* / *5: PAL system (50 fields)*
- P — *P: MP (Coating type metal tape)* / *E: ME (Vapor deposition metal tape)*

Table 1-3. Example of type name indicator of cassette

1-3. TAPE STRUCTURE

The tape structure is as shown in Fig. 1-4, and it is considerably thinner compared with the Beta tape. Metal is used as the magnetic substance in the 8mm video in order to realize high density recording, and there are 2 methods of production, and the magnetic substance materials differ somewhat.

1. MP (Coating type metal tape)

It is an ultra fine-grained alloy in which nickel and cobalt are mixed with iron, and it is coated onto the base material together with a binder (adhesive agent).
The presently produced magnetic tape is almost entirely this coating type with a long record of performance, and it excels in the stability and mass production (= low cost) of maintaining its quality.

2. ME (Vapoar deposition tape)

It is an alloy in which nickel is added to cobalt, and it is vaporized in vacuum and agglutinated to the base material.
Higher performace (high picture quality) than the MP type can be expected, but because it is a comparatively new technology requiring new facilities, the difficulty is in mass production due to problems such as oxidation and compatibility with the head.

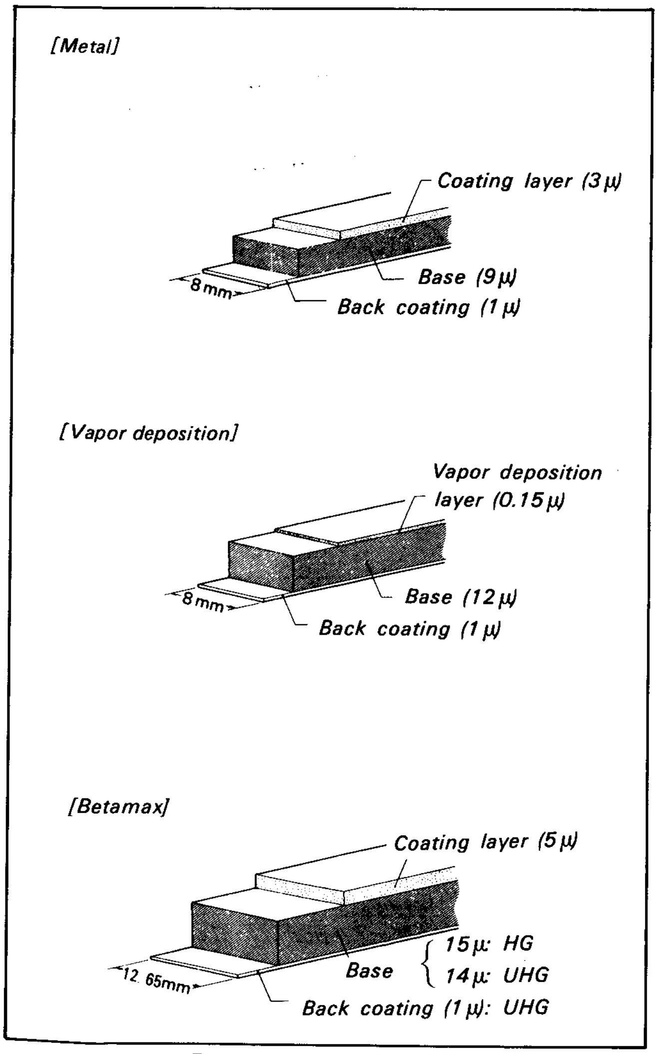


Fig. 1-4. Tape structure

1-4. RECORDING FORMAT

The video signal of the 8mm video is recorded by the low band conversion chroma signal recording. Fig. 1-5 is the recording format on the tape, and that video signal frequency band is as shown in Fig. 1-6.
The 2 head azimuth recording is the same as the usual VTR for home use, but the great difference is that the basic signals (video, audio, tracking and PCM) are all frequency multiplex recorded with the rotating head.

1. Video signal

It is basically the same as the usual VTR as it is a 2 head system in which every time the rotating head rotates by one half (180) it records 1 frame (1 track) each time.

2. Audio signal

As the audio of the 8 mm video uses AFM (Audio Frequency Modulation) as the standard recording system, but since it is monaural, the pilot signal is 1 wave (1.5 MHz). It also has an option the PCM and fixed head systems. When these are not used the respective tracks bexome void. Of these 3 audio recording systems, the AFM audio of the standard system always performs recording and playback irrespective of the existence of the PCM and fixed head systems. (Table 1-4.) Accordingly, even if recording and playback is performed with any other VTRs, the compatibility of video + AFM monaural audio is guaranteed at the least.
Moreover, as seen in Fig. 1-5, the recording tracks and video tracks are independent in the PCM and fixed head systems, and therefore does not affect the video signal. Accordingly, audio dubbing is possible.
In addition, this model is equipped with the 2 systems of AFM and PCM.

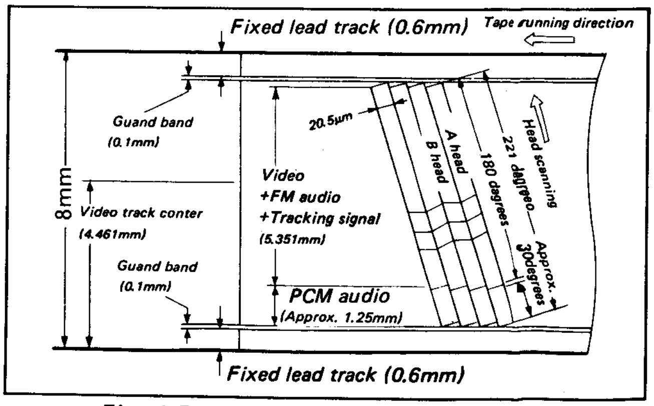


Fig. 1-5. 8mm Video tape recording format

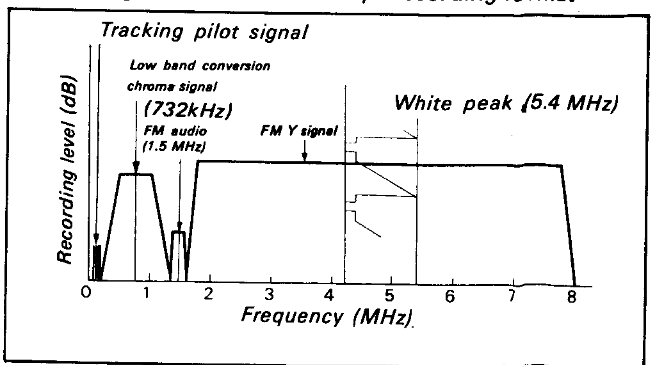


Fig. 1-6. Signal frequency bandwidth (PAL) to be recorded by rotating video head

Item	Fixed head	FM audio	PCM audio
Sound quality	△	○	○
Audio dubbing	○	×	○
Channel	1	1	2
Specification	Option	Standard	Option
Usage	Mainly for audio dubbing	Simultaneous recording with video	Simultaneous recording with video and for audio dubbing

Table 1-4. The 3 audio recording systems of 8 mm video

3. Tracking signal (ATF signal)

The usual VTR for home use employs the so-called CTL system which performs recording and playback with the control signal at the fixed head. In the 8 mm video, however, recording is performed by recording with 4 waves of pilot signals to the rotating head together with the video signal, and controls tracking by comparing with each other during playback. This system which has been proposed by Philips Co. is called ATF (Automatic Track Finding).

The features of the ATF system are

(1) The former fixed head for CTL becomes unnecessary and the high precision position matching of the rotating head and fixed head becomes needless.

(2) Even if contraction occures in the already recorded tape, it can be followed up.

(3) Including the loading mechanism, tape running is simplified, etc.,

and the tracking adjustment knob not only becomes unnecessary, but the tracking precision is highly enhanced.

• Regarding ATF

As shown in Fig. 1-7, the 4 pilot signals (f1 to f4) are recorded in order by 1 signal to each track. In other words, f1 is recorded at CH1 head and next, f2 at CH2 head, the f3 at CH1 head and f4 at CH2 and thereby alternately recorded respectively (f1 and f3 at CH1 head and f2 and f4 at CH2 head). When during playback, the pilot signals of both adjacent tracks are detected and perform tracking control by comparing the levels.

For example, when carrying out playback of CH2 track, the pilot signals (f1 and f3) of both the adjacent tracks (CH1) are detected together with f2. The tape running velocity is controlled and accurate tracking is obtained by equalizing the levels of the difference in levels of the playback pilot signal and the adjacent pilot signals, i.e., so that they become f3 − f2 (45 kHz) = f2 − f1 (16 kHz).

The 4 frequencies are as shown in Fig. 1-8, and even if any track is played back, the difference between the adjacent frequencies are constantly in relationship to 45 kHz and 16 kHz, so it can be acknowledged as to which side of the tracks is displaced by comparing the 2.

The pilot signal is in between 100 kHz and 150 kHz and it does not affect the azimuth angle because of its long wavelength, and it also has the merit of being able to detect sufficient signal even from the adjacent tracks.

The recording level of the pilot signal is suppressed to approximately −14 dB of the color signal recording level to eliminate noise emitting from the screen by interference with the video signal.

(Note) 45 kHz and 16 kHz are not accurate differences but nominal values.

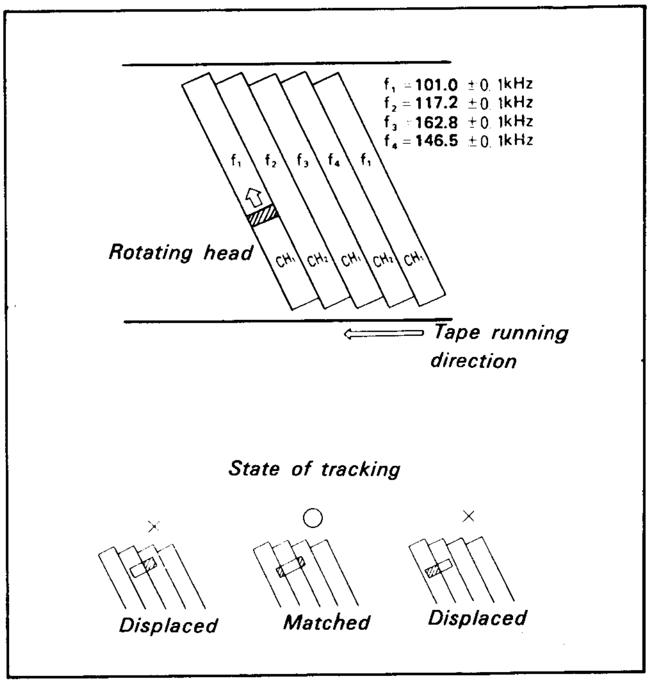


Fig. 1-7.

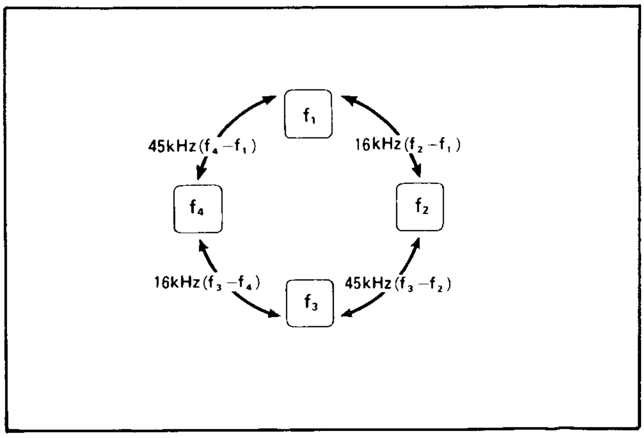


Fig. 1-8.

1-5. REGARDING FLYING ERASE HEAD

This model is equipped with an erase head of the flying erase (FE) method which has earned high approval as a technology of the VTR among the professionals. In the usual home use VTR, erasure has been performed by the full erase method at the fixed erase head of the obliquely recorded image track at the rotating head on the tape, and thereby causing great difficulty in obtaining a clean, liking photography. In the FE method, however, it is synchronized with the image track and erases each track literally with the rotating erase head. By the use of this FE head, the problems such as the rainbow-like noise and color blurring have been solved, and a continuous and beautiful linking photography can be carried out.

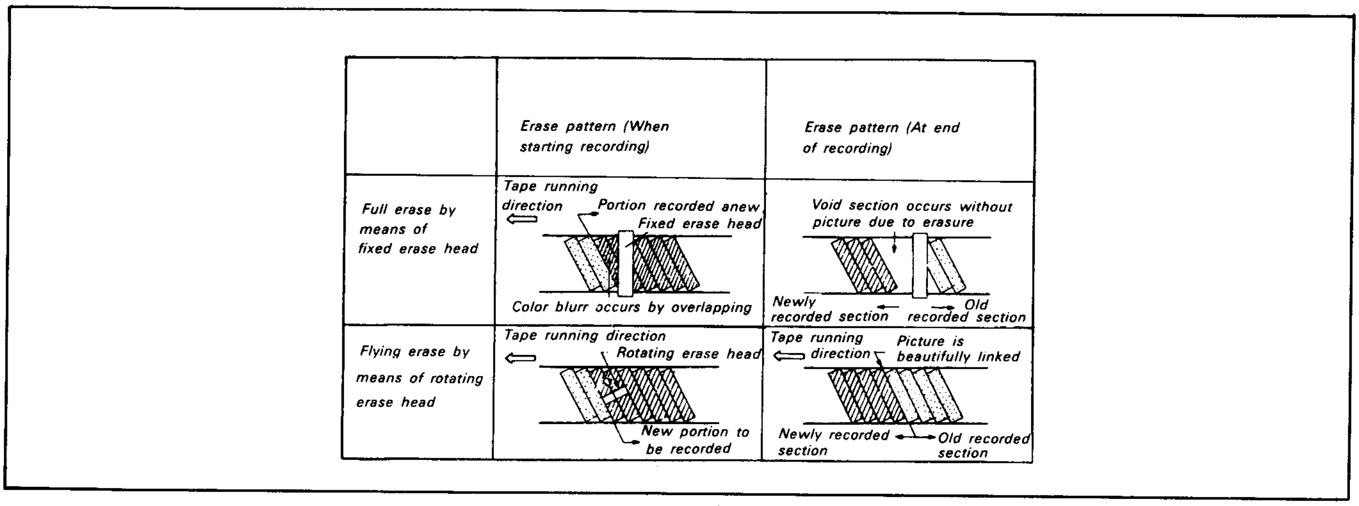


Fig. 1-9.

1-6. REGARDING RECORDING AND PLAYBACK WITH PCM STEREO

See Fig. 1-11. This Fig. shows the cylinder seen from above. To the ordinary wound section of 180° is added an extra 30°, and this section is made as an exclusive area of the PCM audio. In such a method, it becomes necessary, unlike before, to perform the operation of compression and extension of the time shaft.

The theory is described in Fig. 1-12. In the case of recording, there is especially no problem regarding the video signal in relation to time. However, when the PCM audio comes to light, the problem arises of necessitating the change of the section corresponding to 180° to the 30° section. In other words, as shown in the Fig., it becomes necessary to compress the input signal of PCM audio by 6 fold.

In the case of playback. With regard to video signal, there is no problem when the output of the 2 heads are tied together with the pulse by switching. However, with regard to audio, the extracted PCM playback information exists at every 30 in the burst state. In order to transform it into continuous information, the time should be extended this time. The content in which the 30° section is entered must be extended 180° to its original signal. Moreover, it is necessary to be continuously extended to 180°.

In this regard, the time compression and extension are performed by the use of memory (RAM). It can be said that this is possible because of it being a digital signal system.

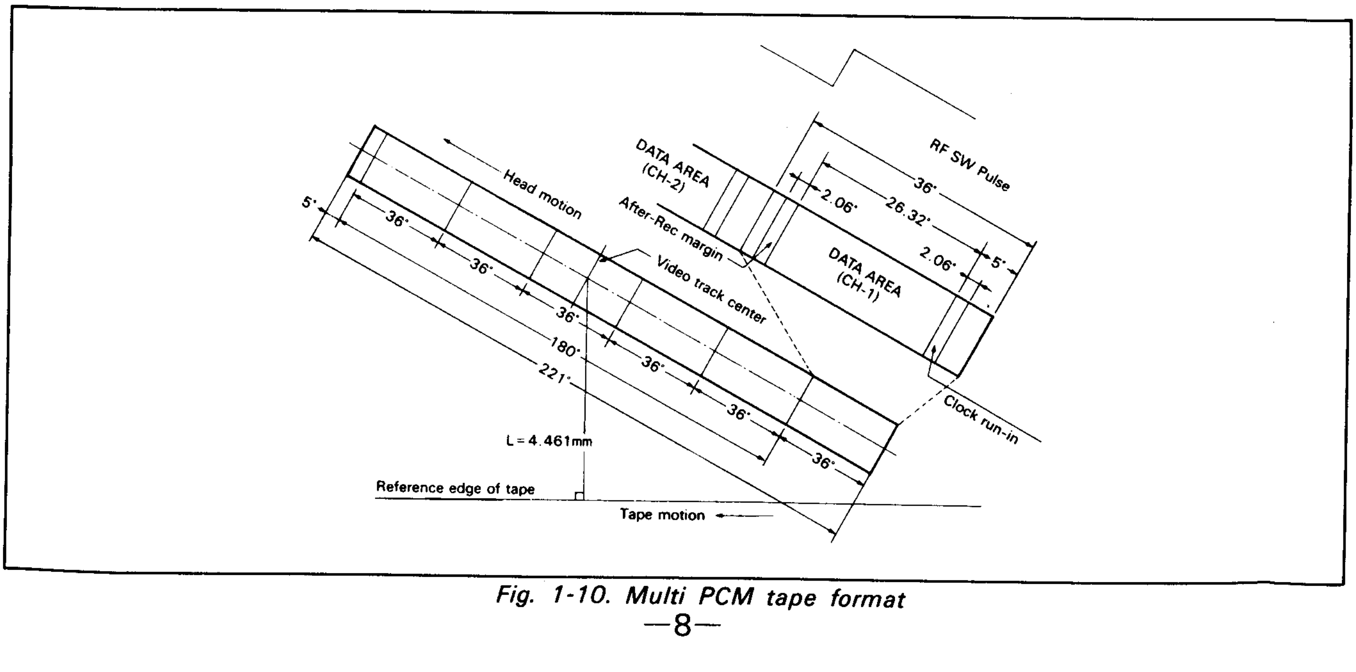


Fig. 1-10. Multi PCM tape format

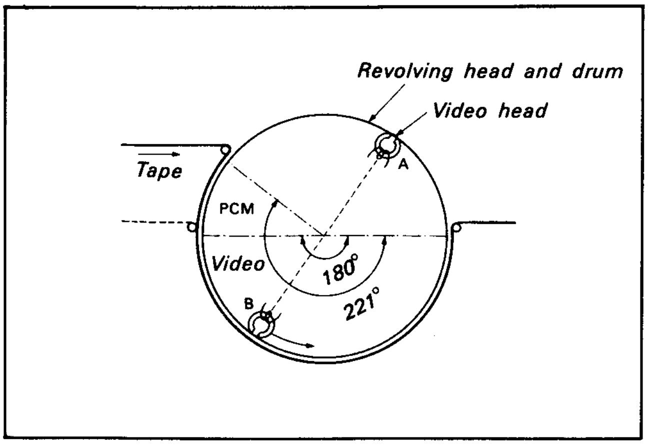


Fig. 1-11. Relation between tape and head

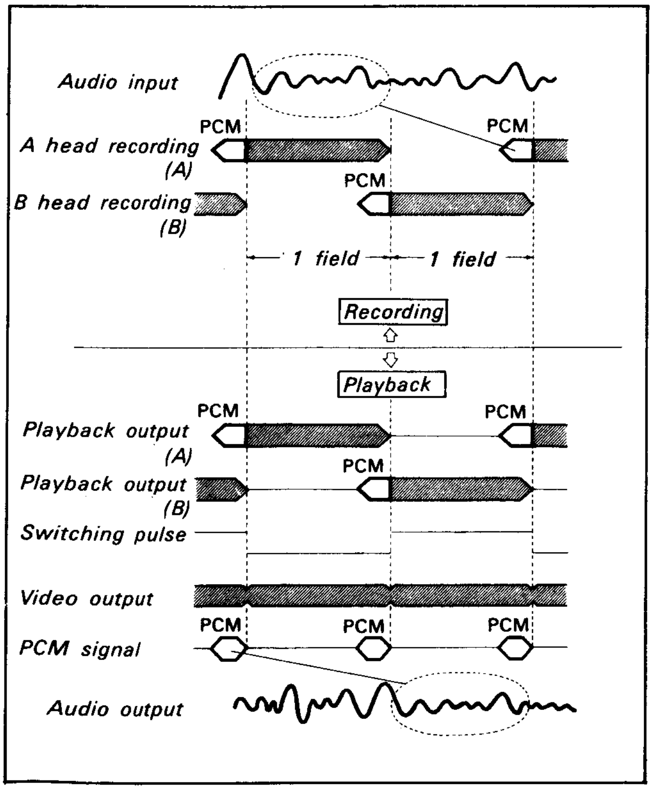


Fig. 1-12. Time compression and extension

1-7. REGARDING THE CHARACTERISTICS OF AUDIO

In the case of PCM, the major controlling factor in determining performance is the 2 elements of sampling frequency and quantization of bit numbers.

Regarding the 8 mm video format, the sampling frequency is two times that of horizontal SYNC frequency, in other words, it is determined at 31.25kHz when expressed as PAL. When sampling is carried out with this frequency, the frequency characteristics which can be played back by the [theorem of sampling] are possible up to [31.25/2] = 15.625 kHz.

The quantization of bit numbers, on the other hand, is 8 bits. There is naturally limitations to the recording of bit numbers under the condition that the tape width is 8 mm, and as the aforementioned stereo information of the section of 30° is to be recorded by adding the code capable of error correction.

However, with the quantizing number being only 8 bits, sufficient value cannot be obtained owing to the effect of the quantization noise with regard to S/N ratio and dynamic range (hereinafter referred to as D range). It is insufficient against Wide D range source of CD (compact disc), etc.

So with the 8 mm PCM audio format, 2 methods are employed, as in Fig. 1-13, in order to expand the D range. One is the introduction of the so-called noise reduction system (hereinafter referred to as NR), and the other is to compress the 10-bit information into 8 bits, in other words, non-linear quantization is performed beforehand to minimize the noise as much as possible in the quantization stage.

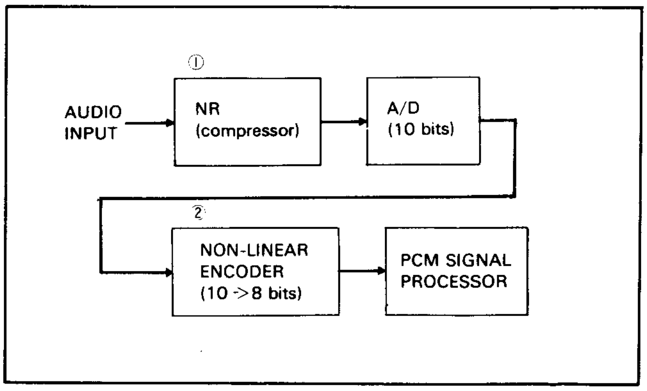


Fig. 1-13. Expansion method of the 8mm PCM dynamic range

1-8. DYNAMIC RANGE EXPANDING METHOD

The 2 methods for expanding the D range mentioned in the prior clause are explained in sequence.

Regarding the NR system, this D range expanding system is very popular today. This method is certainly effective, but it also has some defects at the same time. For example, one of them is that during playback, the audio signal is amplitude modulated by contact or fluctuation of the tape, and the recorded state and the trackability during playback do not match. In addition, there is also the problem of the so-called breathing occurring easily whereby the hiss noise existing in the tape (background noise which has frequency characteristics to some extent) floats and sinks when NR is applied.

Owing to the existence of these 2 problems, a large NR could not be applied with the analog recording system. However, when the PCM audio system is observed, there should not be cause to worry as the analog system. As it is recorded digitally on the tape the amplitude is stable, and it can be handled as the same as white noise as the background noise is not hiss noise but is controlled by the quantization noise, and, therefore, frequency dependability is small with ordinary music signal. In other words, in the PCM audio system, the breathing is hardly audible even if a very large NR is applied. The 8 mm PCM audio employed is called the converter system. The trackability is excellent with the NR method which does not depend upon frequency or input level, and the compatibility between the other manufactures can be easily conducted. As there are 2 compressions, the range double that of which D range already possesses can be expected. Theoretically, as there already exists the D range of 60 dB when quantization has been performed with 10 bits, up to the double of 120 dB can be expected.

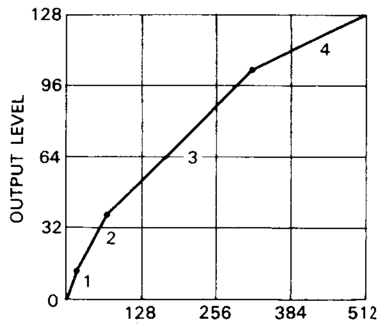
We would next like to describe the non-linear quantization. As mentioned before, there is the difficult restriction of only 8 bits can be recorded on the tape. Under this condition, a method to expand the D range as much as possible has been employed. Concretely speaking, it is performed as follows. (Fig. 1-14.)

The input level and the quantization are relative in relation. Therefore, the input level has been divided into 4 domains, and quantization has been performed to match with the respective levels. Quantization of 10 bits has been performed to the lowest input level where the quantization noise is easily audible and, inversely, 7 bit quantization is performed where the input level is very high because sufficient SN can be expected even if the quantization level is rather coarse. In other words, as there are only portions for 8 bits altogether, it is separated into 10 bits, 9 bits, 8 bits and 7 bits in conformity with the input level, and achieves the decrease of the audible quantization noise.

By employing these 2 methods, we have succeeded in providing a system with a D range in which the best portion is 120 dB and at least 90 dB where it is normally used can be expected.

(a) Conversion Algorithm

	Encoding law	Input digital level	Output digital level
1	10 bits -> 10 bits	0 - 15	0 - 15
2	10 bits -> 9 bits	16 - 63	16 - 39
3	10 bits -> 8 bits	64 - 319	40 - 103
4	10 bits -> 7 bits	320 - 511	104 - 127



(b)Encoding Specification

Fig. 1-14. 8-bits non-linear quantization

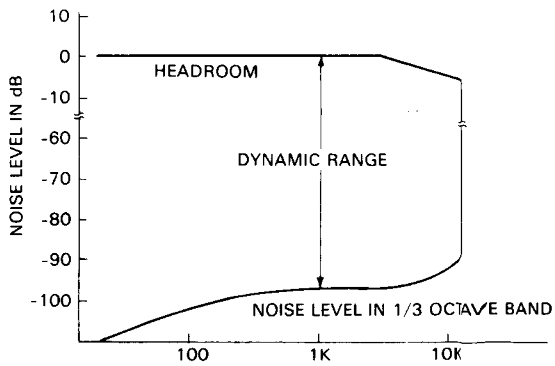


Fig. 1-15. Expanding method of 8 mm PCM dynamic range

1-9. REGARDING THE CIRCUIT STRUCTURE OF THE VIDEO AND PCM AUDIO SYSTEMS

The PCM audio system of this model is composed of the audio signal processing block which performs quantization with the NR block, block which performs error correction, and block which records digitally on the tape. The video and audio signals processing blocks are independently realized respectively, but where the recording is actually carried out on the tape, both signals are mixed or switched and is recorded and played back through the medium of the same hardware. As is natural, this condition as to how the recording is made on the tape must be taken into consideration.

Regarding the method for recording on tape, as the video signal is the guard bandless azimuth recording method (provides 2 azimuths and write in fully without guard band), :f PCM audio recording cannot also be guard bandless ızimuth recorded, the compatibility cannot be maintained. In addition, when with audio dubbing etc. the rewriting of the PCM recording is desired, it is also necessary to secure the overwrite characteristics. Moreover, as the hard ware is used in common partially, it is nesessary to take into consideration the compatibility, etc. with the video signal.

From this viewpoint, a recording method in which the signal is concentrated to the short recording wavelength is desirable. As a result, the 8 mm PCM audio employs a so-called Bi-phase modulation method. See Fig. 1-17. In other words, it is a modulation method in which repetition is once for 1, and half for 0 when the patterns are 1 and 0. (In short, the frequency is doubled with 1.) This is a technique which is relatively old, and it is method whereby its research and analysis have been full mode.

When this is reobserved in relation to the video signal, it is recognizable that the frequency spectrum of the PCM audio signal has almost the similar spectrum to that of the YFM signal in the overall bandwidth including the peak. Accordingly, the entirely same circuit as the electromagnetic conversion system (recording, playback amplifier, head, tape, etc.) which records video signal can be used. Moreover, as the spectrum is drawn near to the high frequency, the azimuth effect can be expected and azimuth Beta recording is also possible.

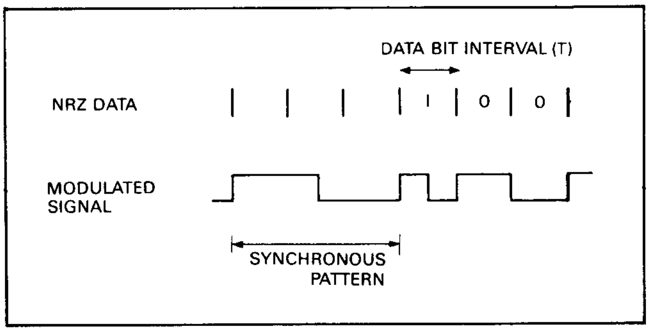


Fig. 1-17. Bi-phase modulation rule

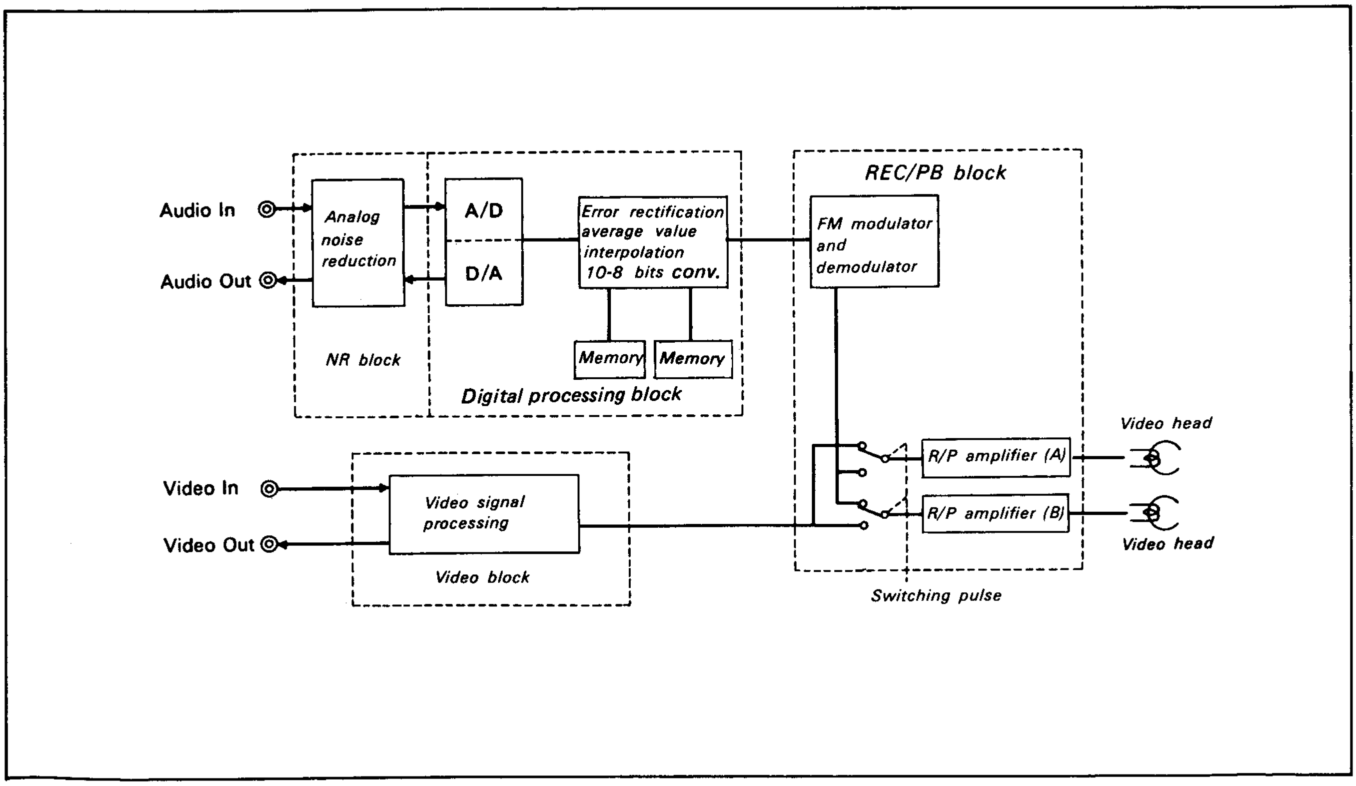


Fig. 1-16. Signal processing block of PCM audio

Regarding the error rate, see Fig. 1-18. This Fig. indicates the bit error rate at LP mode of NTSC, but as the tracking happens to be applied in the state whereby the pattern recorded is accurately traced, it becomes the data close to minus 6 times of 10 and exceeding the approximate level of minus 5 times of 10. Regarding this model, the error rate is further at a low. This characteristic depends on the performance of the head and tape or dependent upon the circuit processing.

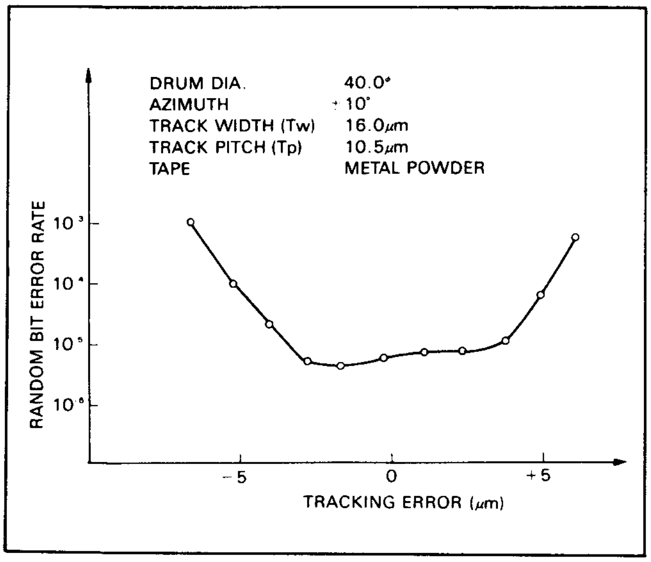


Fig. 1-18. Tracking error and bit error rate (NTSC LP mode)

1-10. REGARDING THE RECTIFICATION OF ERRORS

As shown in Fig. 1-19, the quantization with 10 bits is converted to 8 bits as a unit to correct errors in the 8 mm PCM audio system, and 8 units are collected and 2 parity words are attached to them. In short, 2 parities against 8 words. This is determined as 1 block.

Checking is performed with CRC to see whether there is any eeror in the 8 words, and if and error is detected, correction is carried out with use of the 2 parities. The Fig. is drawn sidewise for convenience sake, but when the words are arranged vertically, as shown in Fig. 1-20, and are expanded into 1 field, there are a total of 157 blocks aligned. Against the overall 157 blocks, 1 parity is attached at intervals and the other parity is attached in the same manner. (As the 2 parity systems are used at intervals they are called cross interleave.) In this way, when the data is incorrect due to some kind of error, even if it cannot be corrected with 1 parity, restoration becomes possible with the other parity. The ability of the individual parity is not very high, but by applying interleave, a very high correcting ability can be obtained.

The reason for performing interleave to this parity will be described. The tape is recorded in sequence from the first block, but when dropout occurs and there are errors, not only 1 bit but a great amount of bits become incorrect simultaneously. Then, even if an error is detected at CRC, if the parity which is supposed to rectify the error is placed at the same place as the error, the error cannot be correct because they both become inoperable. Therefore there is no meaning if the parity is not placed separately from the data to be corrected. There is, of course, the problem of the correcting ability becoming high and low due to the way it is jumped and the inclination of the parity. So with this equipment, a very large correcting ability is now obtained by determining the distance and inclination and therefore causing the correcting ability to become absolutely high by driving the computer simulator. In this case when the bit error is −5 times of 10, the probability is that only one word a day cannot be corrected according to calculation, as shown in Fig. 1-21.

For example, when the sound of the multiple PCM is being listened to continuously for 24 hours, it means that there will appear a place once where the correction cannot be performed. However, as the accurate information from before and after the erroneous portion actually interpolates in approximation the error, the difference is hardly audible. As this is strictly the calculating value, so when it actually happens to the experiment value on the tape, the rectifying ability becomes even higher.

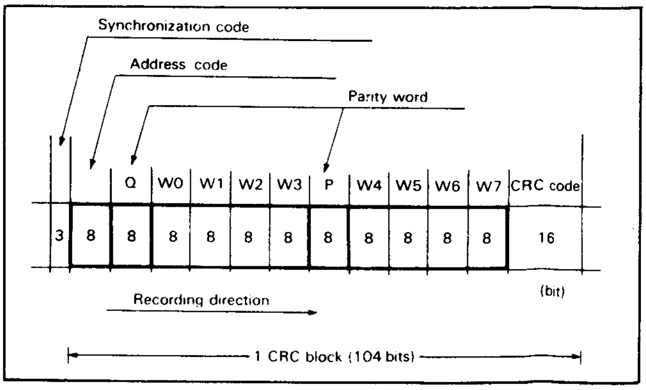


Fig. 1-19. Error correction block

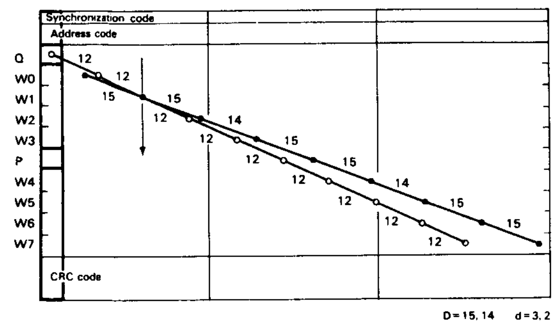


Fig. 1-20. How to apply parity system (In the case of NTSC)

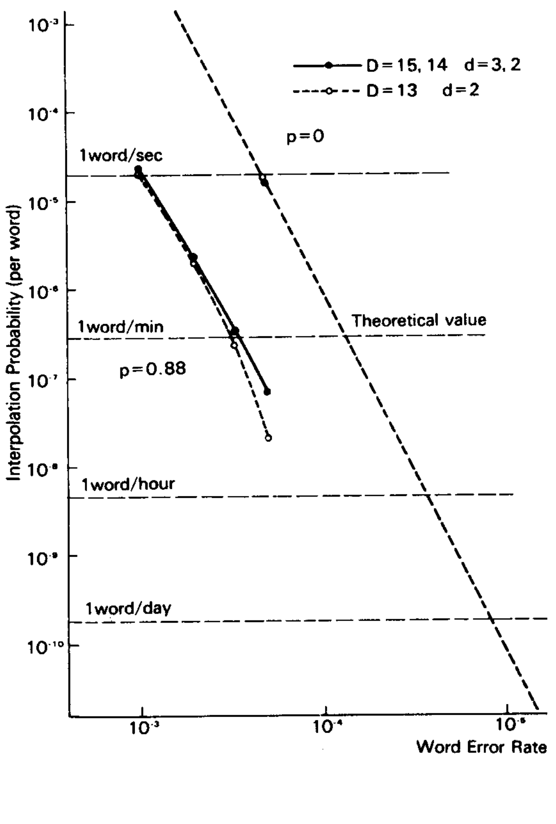


Fig. 1-21. Rectifying ability of the cross interleave code

1-11. REGARDING THE MULTIPLE PCM

See Fig. 1-10. When video tracks are all used for audio in the multiple PCM, the actually recorded format within 30° is exactly the same as the PCM signal processing method which has been determined for the 8 mm VTR. Therefore, it is realized comparatively easily by merely controlling the recording position. Regarding the technological point, when performing application of tracking with the video and PCM, up to now it sufficed to operate at the 180° section of the video, but because each track now becomes independent signal, tracking operation with multiple PCM should be performed in the 30° section.

Normally, 8 mm video signal is recorded as shown in Fig. 1-5., however, if this video section is desired to be used entirely for PCM, 6 units of the PCM section of approx. 30° can be provided on the track as shown in Fig. 1-10.
If this section is intended to be used exclusively for audio, various music sources can be recorded and played back at any section among the 6 sections with multi-channels.
Moreover, when P5-90 (90 minutes in SP mode) tape is used, recording of 1.5 hours (3 hours in LP mode) per channel is possible, and therefore, totally 9 hours (18 hours in LP mode) of recording and playback are possible.

SECTION 2
VIDEO CIRCUIT

2-1. LUMINANCE SIGNAL RECORDING SYSTEM

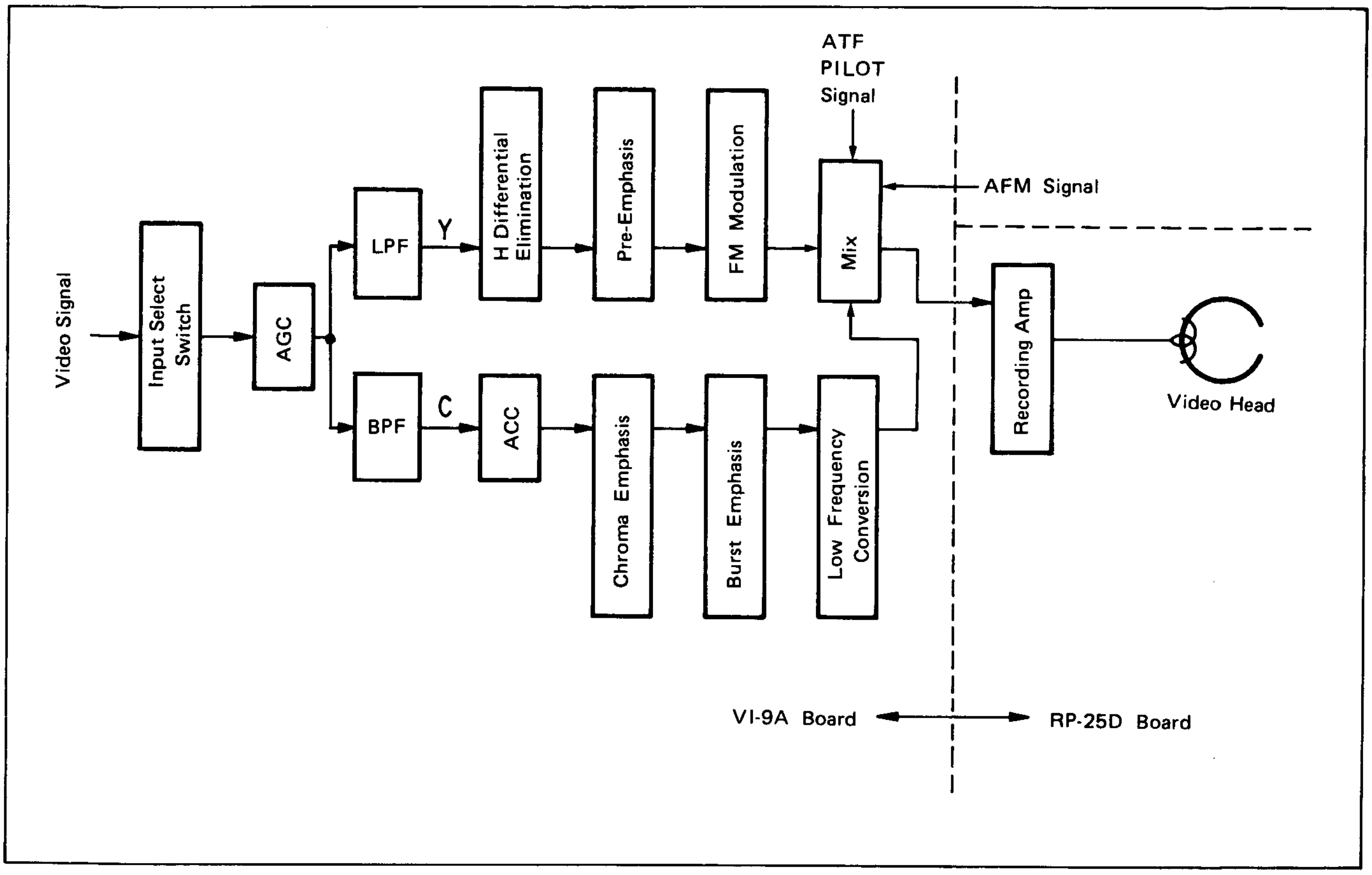


Fig. 2-1. Recording System Block Diagram

1. INPUT SELECT SWTICH

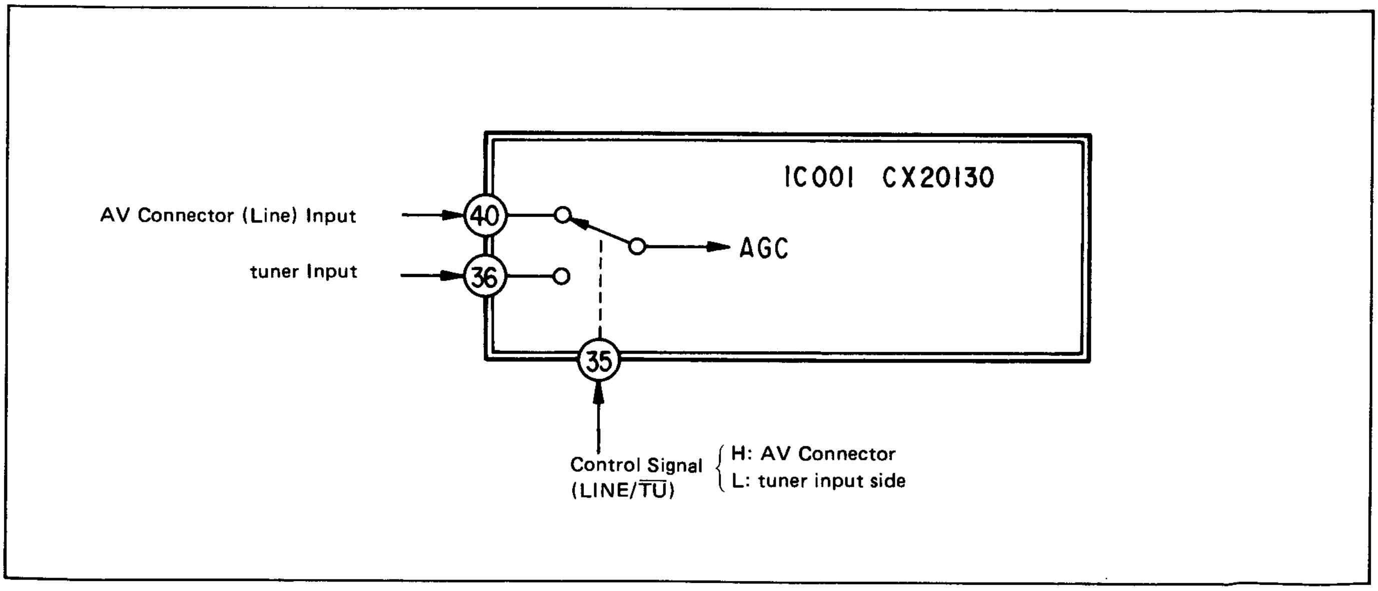


Fig. 2-2. Input Select Switch

The AV connector input and tuner input are switched by the control signal from Pin ㉟ .

2. AGC CIRCUIT

The SYNC + PEAK AGC system is employed for the circuit to hold the input signal level constant.
Y signal fed from Pin ㉛ , after the SYNC TIP clamping, is sampled by the AGC pulse and feeds back an error signal to the AGC Amp. There is only one adjustment VR because Peak AGC is so composed as to operate in proportion to the SYNC AGC.

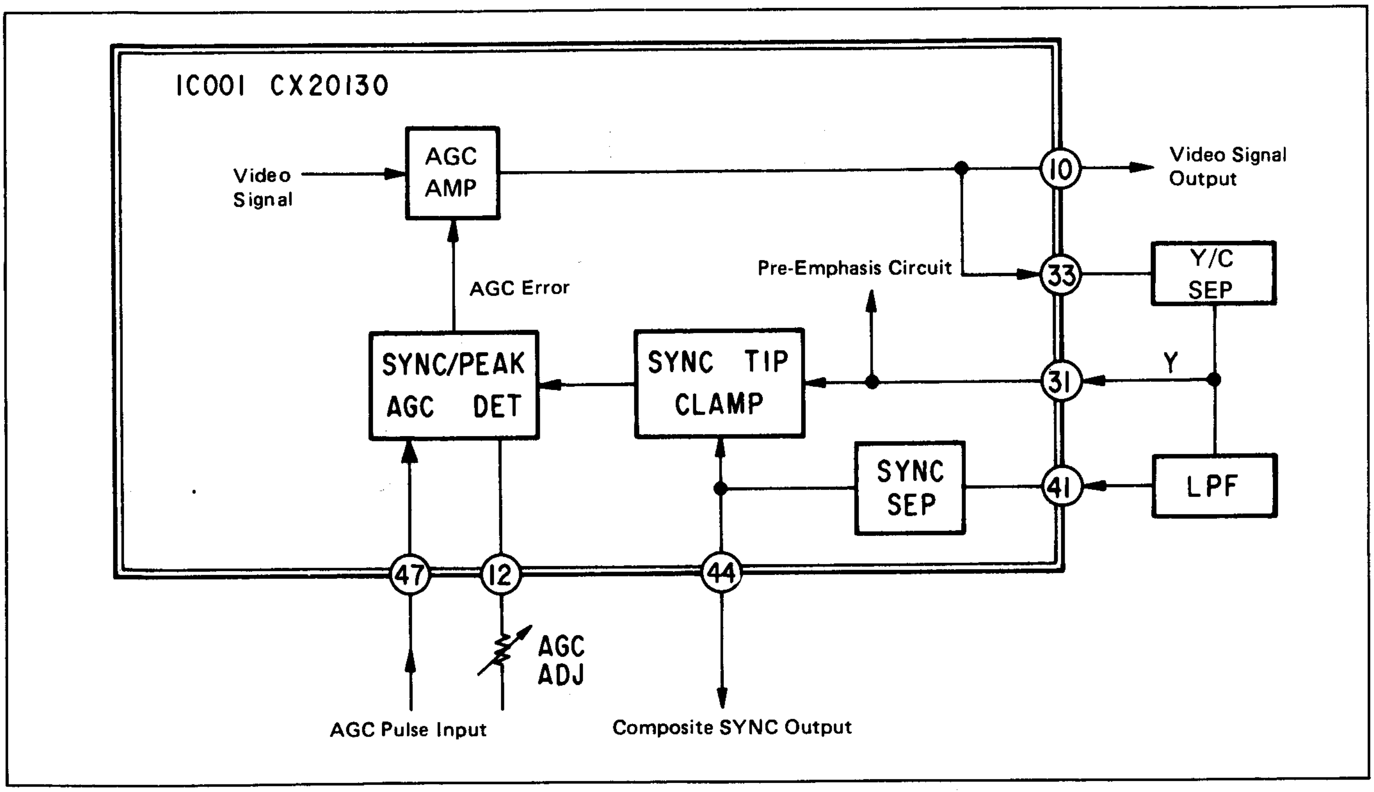


Fig. 2-3. AGC Circuit

3. Y/C SEPARATION CIRCUIT

Y/C separation is performed in order to record after the Y signal makes FM modulation and Chroma signal makes low frequency conversion (4.43MHz → 732kHz).

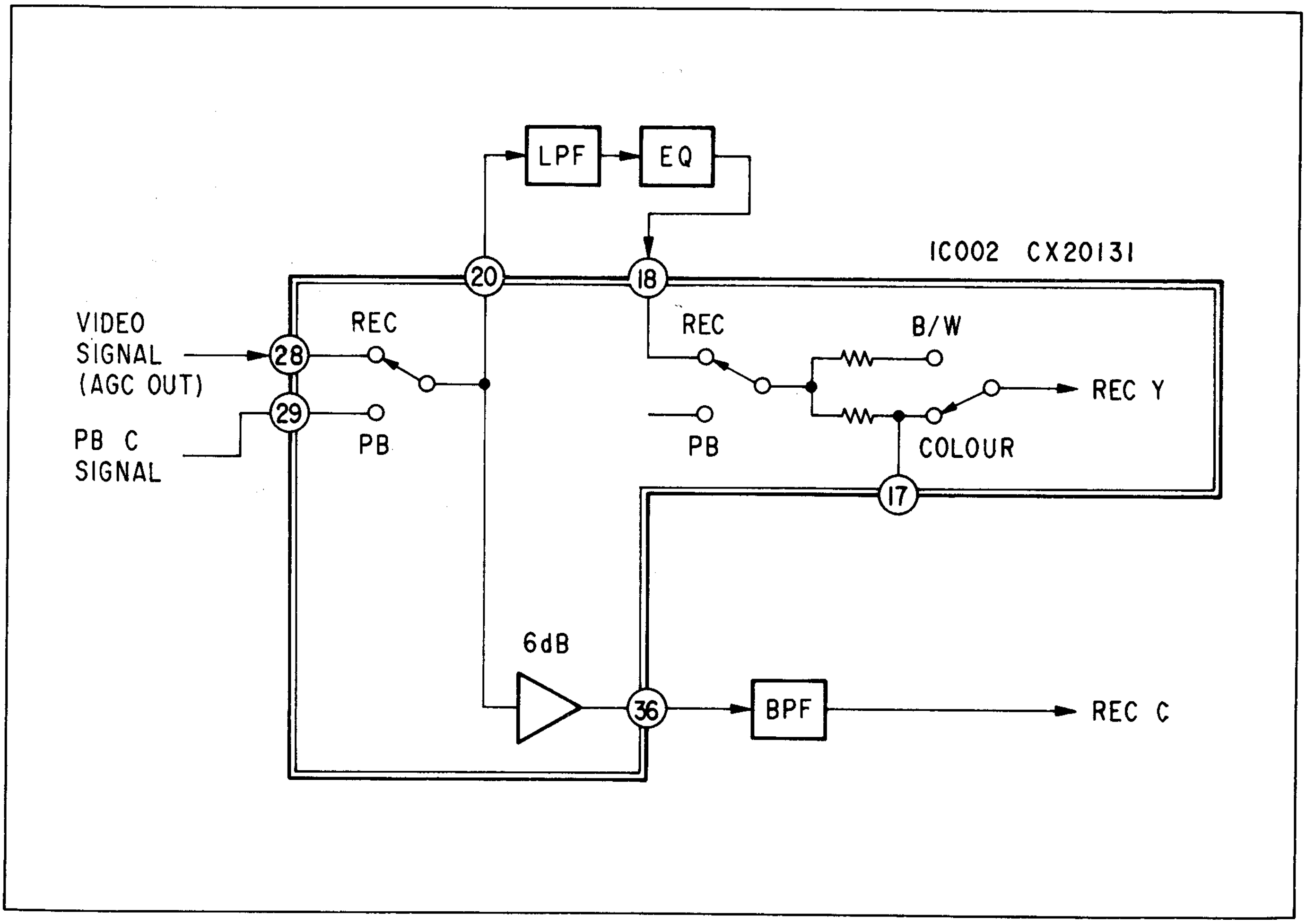


Fig. 2-4. Y/C Separation Circuit

The composite signal of the AGC circuit output passes through CX20131 and is output to Pins ⑳ and ㊱.
This circuit operates as a comb-type filter for chroma signals using a 2H delay line during playback. However, it does not operate on RECORD mode.
The output of Pin ⑳ is input to the LPF and equalizer to separate the Y signal and to compensate phase characteristics disturbed by the LPF. The output of Pin ㊱ is input to the 4.43MHz BPF to separate the chroma signal. The 6 dB amplifier, which is at Pin ㊱ of CX20131, compenstates losses of the signal level by the BPF.

4. Y COMB-TYPE FILTER

When recording, it is used to remove line crawling. Y-FM signal lets adjacent track have a 1/2 fH offset, and lets a crosstalk interleave against the main signal. When playing back, the crosstalk is removed by a comb-type filter. If there is a line crawling, the exact 1/2 fH offset is impossible and the removal rate of the crosstalk goes down.

4-1. Line Crawling (H Differential)

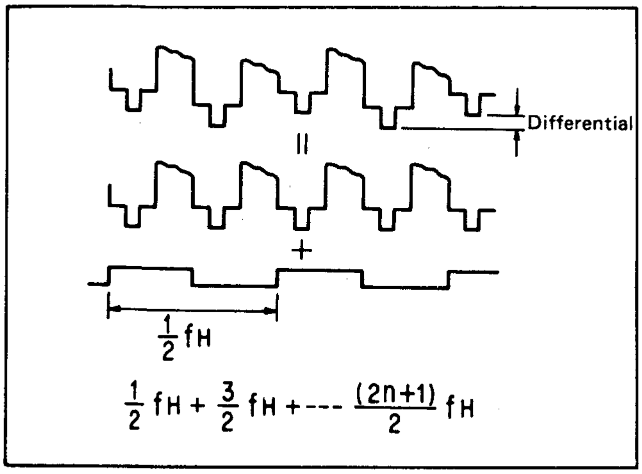


Fig. 2-5. Line Crawling Signal

A signal with line crawling is considered to have overlapping of 1/2 fH square waveforms. When a signal having line crawling is modulated to FM, the specturum is as shown in Fig. 2-6.

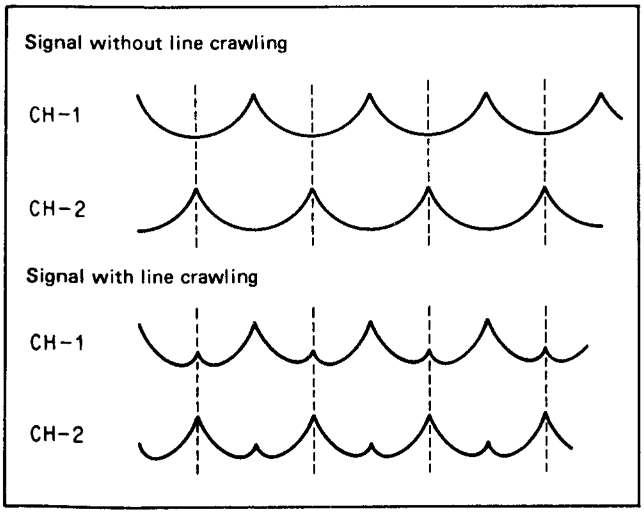


Fig. 2-6. FM Modulation Spectrum

Thus, a comb-type filter is prepared, and when its characteristics become like the one shown in Fig. 2-7, it locates itself at the valley-like bottom position and it can be eliminated because the line crawling frequency spectrum is an odd number of the 1/2 fH.

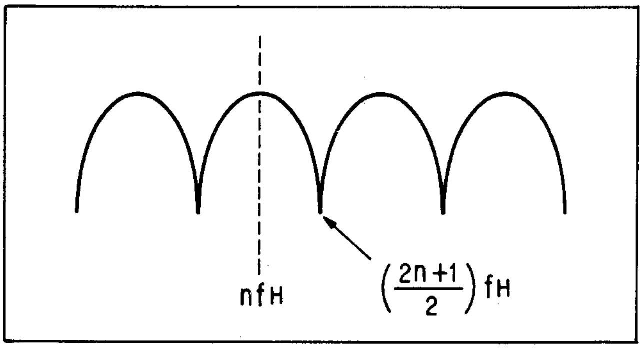


Fig. 2-7. Comb-Type Filter Characteristics

4-2. 1H DL Circuit

Glass DL is used as a DL element. 1H delay signal is obtained by AM modulation because a video signal cannot be passed through as it is.

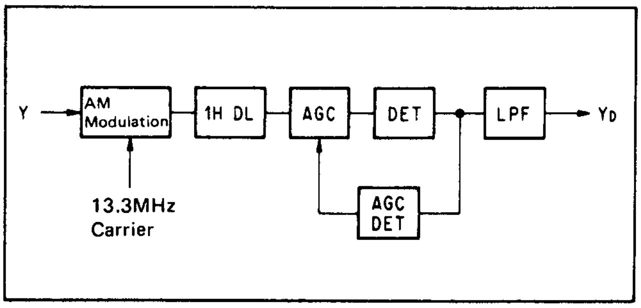


Fig. 2-8. 1H DL Circuit

A video signal is made AM modulation by 13.3MHz carrier, and is passed to the 1H DL line. Its loss in the DL line is supplemented by the AGC Amp and it is detected.

4-3. Y Comb-Type Filter Circuit

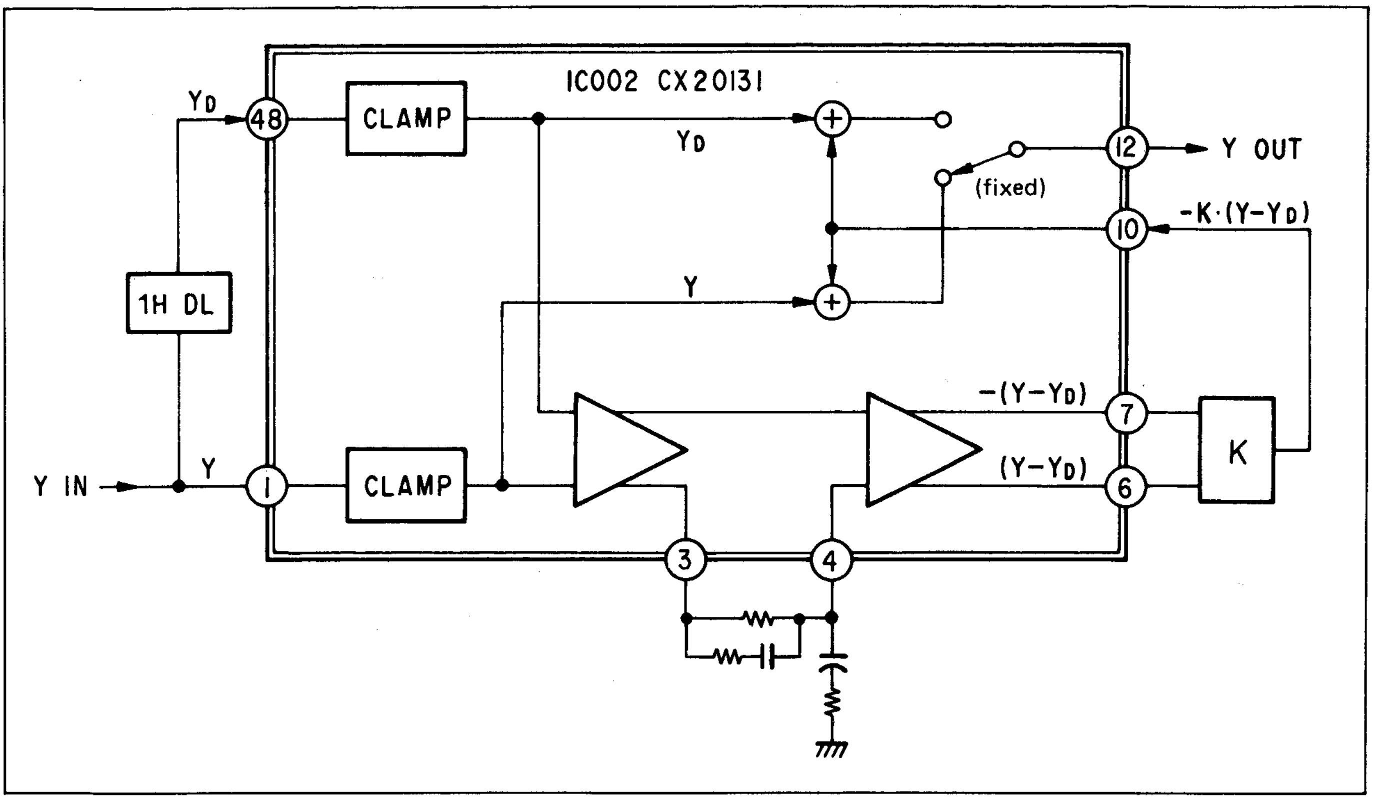


Fig. 2-9. 1H DL Circuit

Y signal made Y/C separation is fed to Pin ① and composes a comb-type filter by the outputs (Y-YD) from Pin ⑥ and ⑦ , then the line crawling is eliminated, and is fed to pin ⑫ as REC Y signal.

5. PRE-EMPHASIS CIRCUIT

5-1. Operating Principle

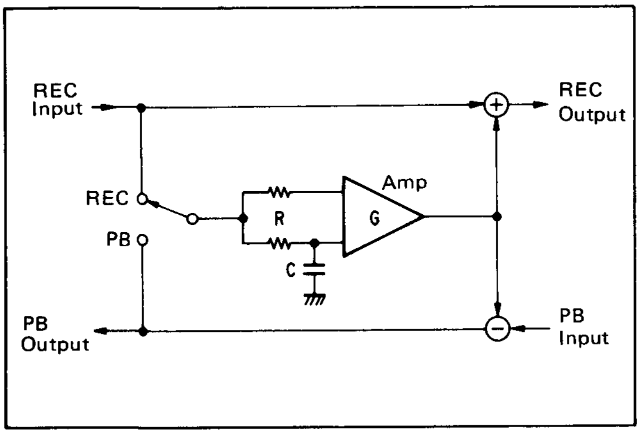


Fig. 2-10. Emphasis/De-Emphasis Circuit

At the time of registering, the transmission founction

When recording, the transmission function $H_{(s)REC}$ is

$$H_{(s)REC} = 1 + (1 - \frac{1}{1+SCR}) G = \frac{1+SCR(1+G)}{1+SCR}$$

emphasis time constant $T = CR(1+G)$

Herein, if Amp G is let to have non-linearity and the G is kept variable responding the input level, non-linear emphasis characteristics can be obtained.

And at the time of playing back, the transmission function $H_{(s)PB}$ becomes as follows:

$$H_{(s)PB} = \frac{1+SCR}{1+SCR(1+G)} = \frac{1}{H_{(s)REC}}$$

The time constant and the non-linear circuit can be used together to obtain the converse transmission function at the time of recording.

5-2. Pre-emphasis Circuit

The pre-emphasis circuit is composed of a sub-emphasis circuit and main emphasis circuit. In the sub-emphasis circuit, the non-linear emphasis and deviation settings are performed. In the main emphasis circuit, linear emphasis and W/D clip are in operation.

[**Sub-emphasis Circuit**]

Y signal fed to Pin ㉛ in IC001 divides into two. The one is directly fed to the addition Amp and the other to the limiter Amp. The limiter Amp also composes an HPF (high-pass filter) by the C and R connected with Pin ㉗. The limiter Amp output, the emphasis gain setting and phase correction are performed by C and R between Pin ㉖ and ㉕, and is fed to the addition Amp. Although the addition Amp is a differential Amp, it turns out to be a circuit for addition function since the negative side of the input signal is phase-reversed by the limiter Amp. This Amp gain is controlled by a dc. voltage from Pin ㉚ and the deviation setting is conducted.

- In case of the input level being low (below −20dB, compared to the standard input 500mVp-p), a high frequency component of the Y signal picked out by the HPF is fed, without receiving limiter function, directly to the negative side of the addition Amp. Thus, high frequency emphasized Y signal can be obtained for the addition Amp output.
- When the input level is high (above −20dB compared to the standard input 500mVp-p), a high frequency component of the Y signal picked out by HPF is operated by the limiter and is fed at a fixed level to the negative side of the addition Amp. For this reason, the higher the input level of the high frequency emphasis volume of the Y signal resulting from the addition Amp output, the smaller will be the end results.

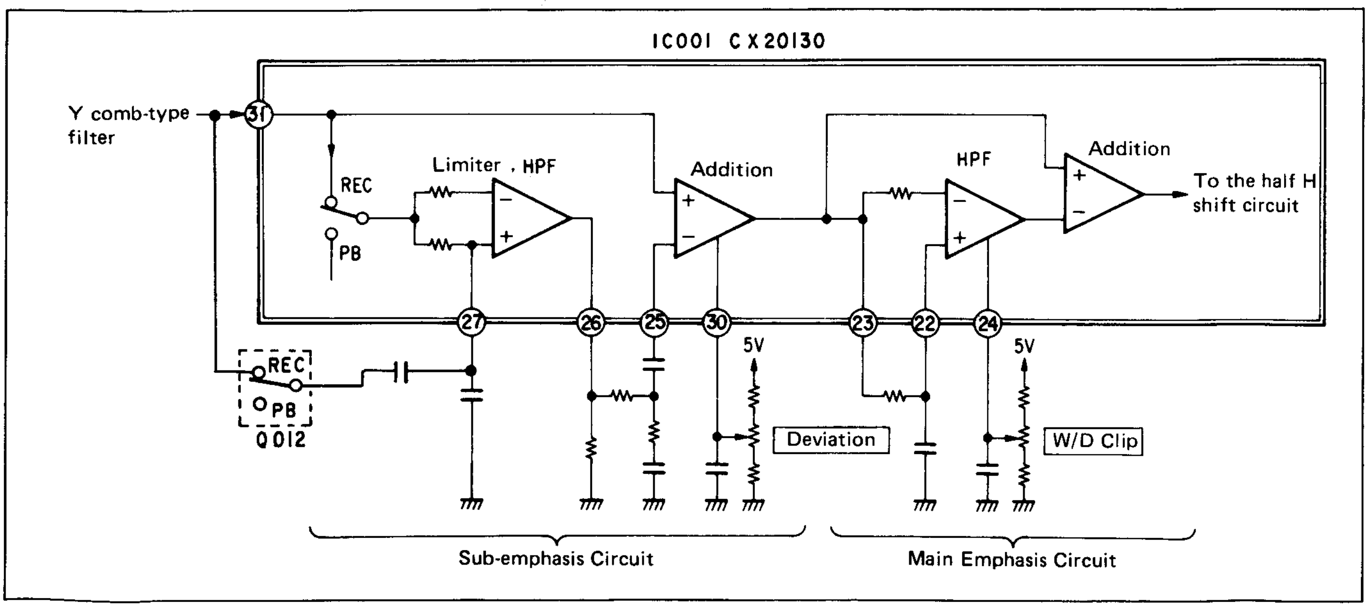


Fig. 2-11. Pre-Emphasis Circuit

[**Main Emphasis Circuit**]

The Y signal coming out of the sub-emphasis circuit is divided into two. The one is directly fed to the addition Amp and the other, passing through the HPF Amp, is fed to the addition Amp. A differential Amp is used for the addition Amp but the substraction function will not take effect because that the phase reversing has been even in this case by the HPF. The HPF characteristics are set by C and R between Pin 23 and Pin 22 . The emphasis is performed by adding Y signal high frequency component but linear emphasis is conducted without the limiter function at a regular level. The volume of linear emphasis can be changed by controlling the HPF Amp gain by a dc. voltage from Pin 24 .

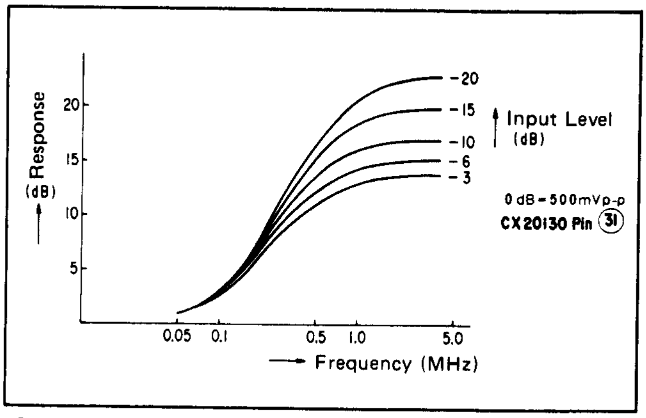


Fig. 2-12. Integrated Pre-Emphasis Characteristics

6. 1/2 f_H SHIFT

To eliminate influences by crosstalk from the adjacent track (especially, H synchronizing signal from the adjacent track), a 1/2 fH frequency difference is given between the CH's by FM wave.

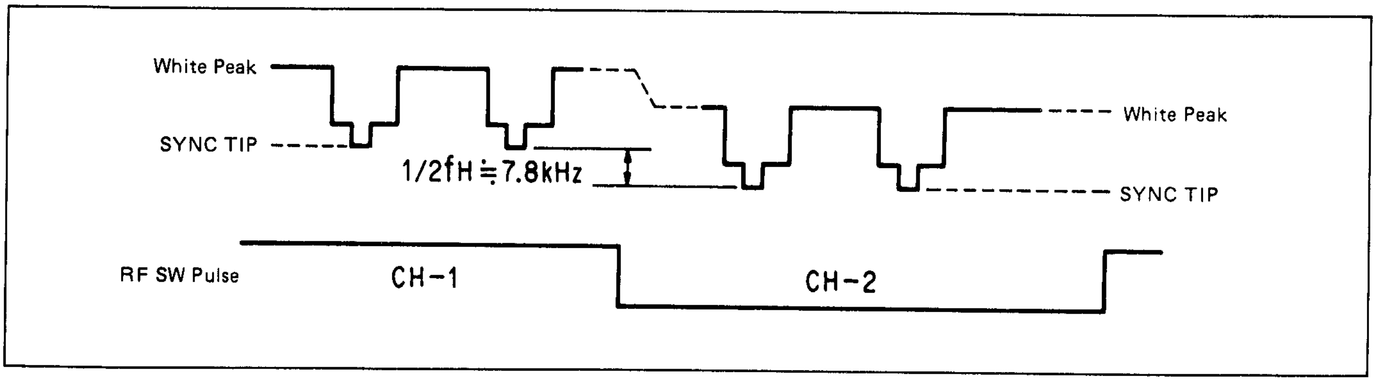


Fig. 2-13. 1/2f_H Shift

Only the CH-1 side signal shifts by about 7.8kHz and the beat disturbance caused by crosstalk from the adjacent track interleaves against the demodulated original signal in terms of spectrum.

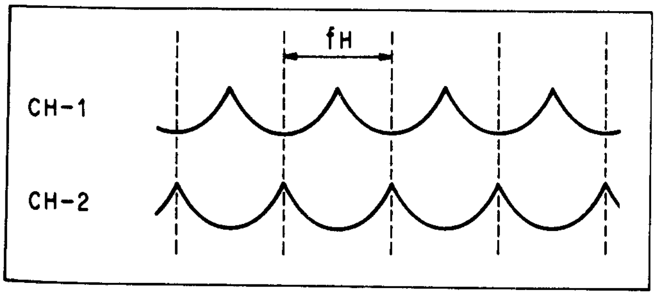


Fig. 2-14.

The side band energy component of the CH-2 track spreads at a interval of f_H. If the carrier frequency of the CH-1 track is raised by 1/2 f_H, the peak and bottom parts coincide. When playing back, the crosstalk component can be eliminated by passing it through the comb-type filter.

6-1. 1/2 f_H SHIFT CIRCUIT

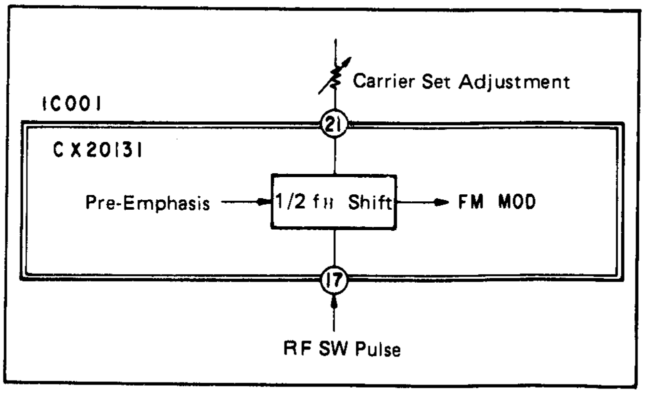


Fig. 2-15. 1/2 f_H Shift Circuit

1/2 f_H shift is performed by the RF SW pulse fed to Pin 17 , there is no adjustment conducted.

7. FM Modulation

FM modulation is performed by varying the modulator input current into Y signal with the use of emitter couple and monomulti.

An oscillation frequency can be changeable by the DC level at Pin ㉑ and resistor connected with Pin ⑱ . The signal modulated to FM is issued to Pin ⑮ and a low frequency conversion chroma signal and part equivalent to AFM signal are removed by the trap. (Half Trap)

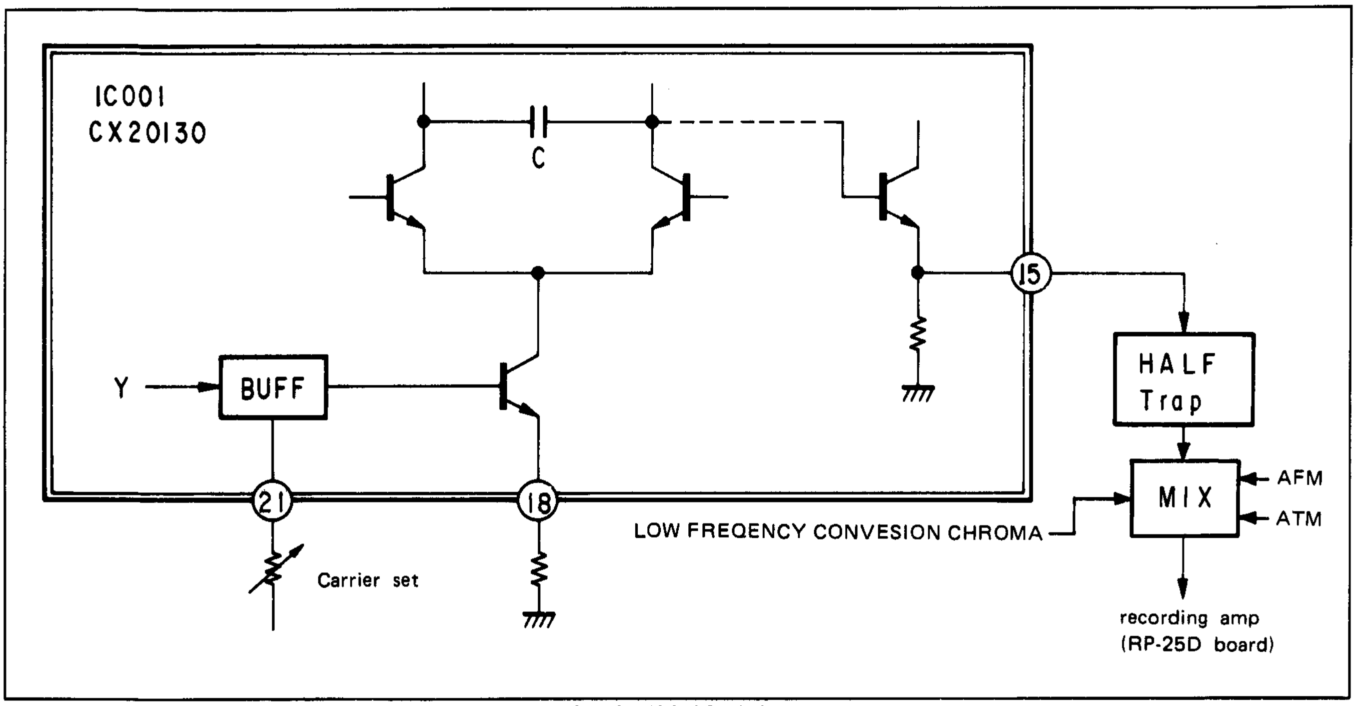


Fig. 2-16 FM Modulator

8. RECORDING AMPLIFIER

The Y signal which has passed through HALF Trap output from CX20130 pin ⑮ of VI-9A board is mixed with the low range converted chroma signal and ATF signal together with the AFM signal from PC-14B board, and are input to CX20034 pin ① of RP-25D board.

These 4 signals, after being level controlled by the DC voltage of pin ㉑ , are V→I converted and are supplied to the video head after passing through the recording amplifier and rotary transformer.

Moreover, the PCM signal which has been output from pin ⑫ of IC103 (CX20142) of PC-15B board is mixed with the ATF signal within the VI-9A board and they are input to CX20034 pin ㊻ of RP-25D board. These two signals are level controlled by the DC voltage of pin ㉒ and then after being V-I converted, are supplied to the video head after passing through the recording amplifier and rotary transformer.

The selection between the Y/C/AFM/ATF signals and the PCM/ATF signals is carried out with the PCM REC signal input to pin ⑥ and RP RF SW pulse input to pin ②.

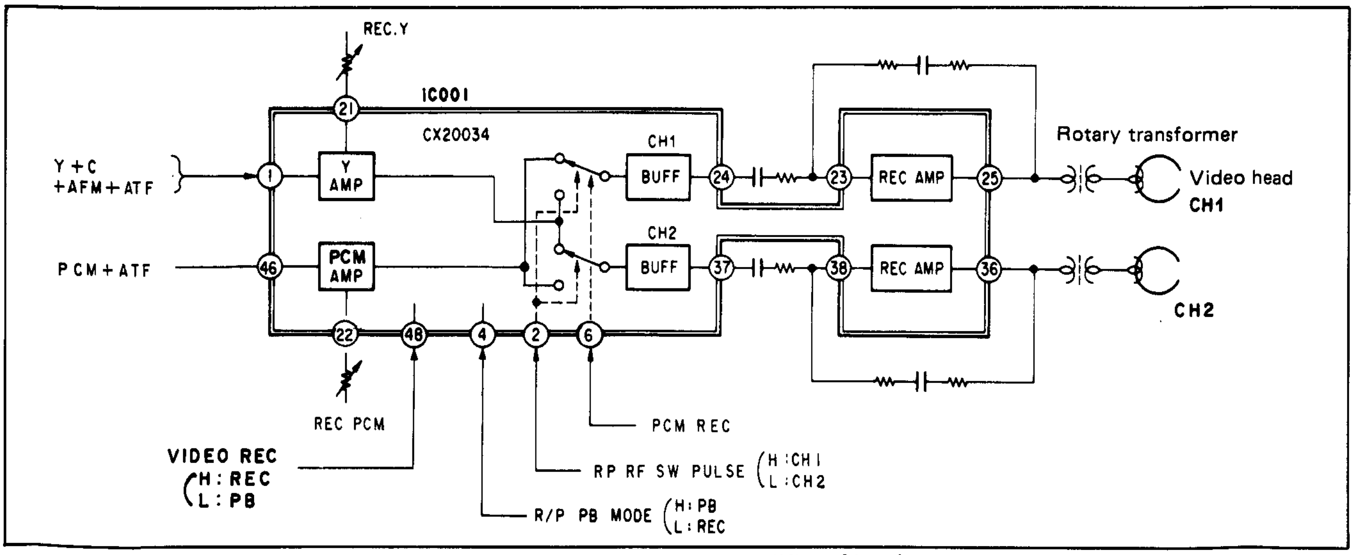


Fig. 2-17. Recording Amplifier Circuit

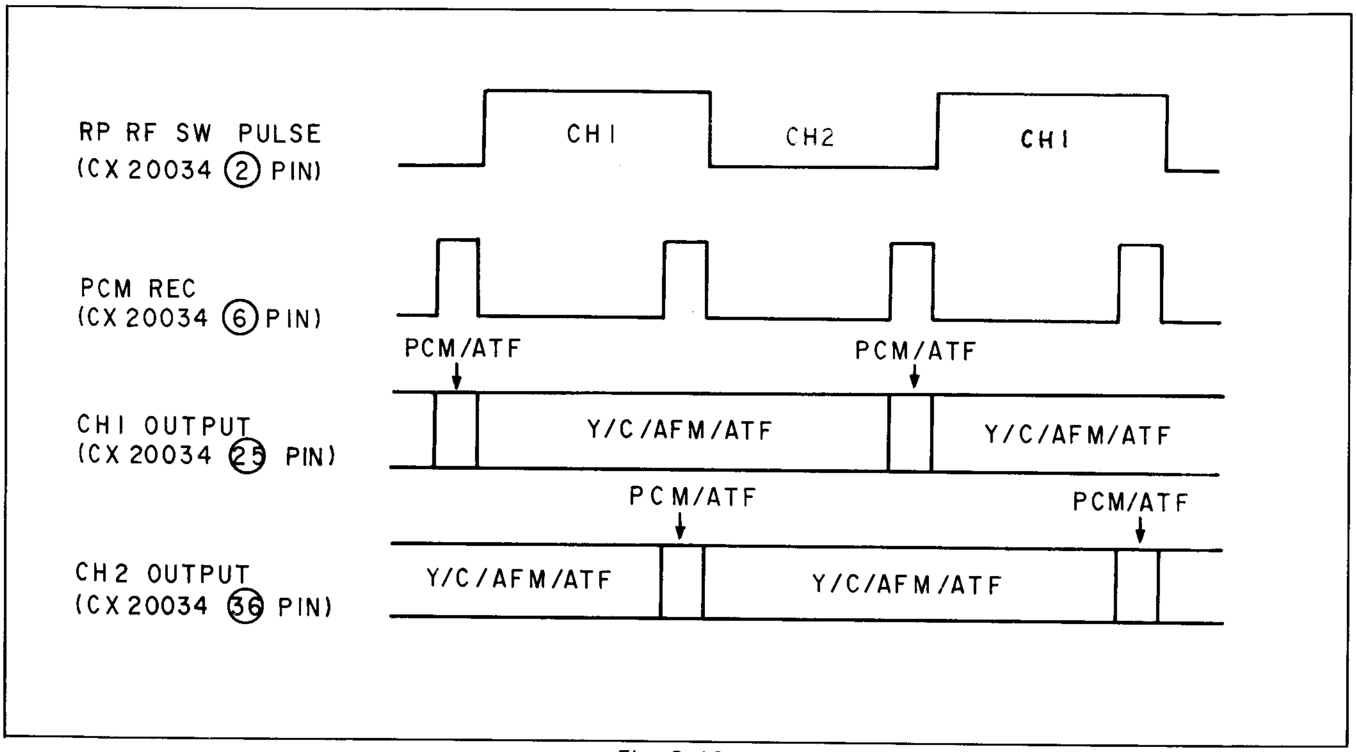
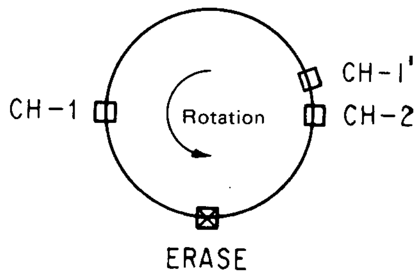


Fig. 2-18.

[Rotary transformer]

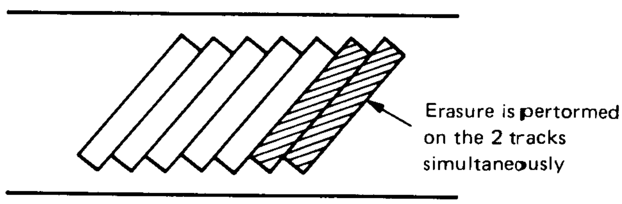
It is 4-ch structured and is stepped up during playback with the winding ratio of the head side and stater side being 3:5.
Inner side..... Erase head
2nd from inner side..... CH-1'
3nd from inner side..... CH-2 (RF SW pulse − side)
Outer side..... CH-1 (RF SW pulse + side)



[Video head]

Video head	3 heads	(CH-1/CH2 track width 27 μm) (CH-1' track width 27 μm)
Erase head	1 head	(Track width 68 μm)

By mounting erase head onto the drum, erasure is performed in parallel with the video track.



2-2. Y SIGNAL PLAYBACK SYSTEM

1. PLAYBACK AMPLIFIER

CH-1 only (CH-2 is also the same)

The playback signal from the head is input to the head amplifier from pin ㉖ after passing through the rotary transformer. As the f characteristics during playback is turned to the vicinity of 6.5 MHz to 7.5 MHz, apply feedback damping so it becomes flat.

The selection of the playback signal is performed by the RF SW pulse which has been input to pin ② and CH-1 is selected when H, and CH-2 when L, and, normally, a continuous signal can be obtained to pin ⑧ during playback. (See Figs.2-19 and 2-20.) (However, during varying-speed playback, pin ⑦ becomes H and CH-1' is output instead of CH-2 output.) Regarding PCM signal which is inverse to the video signal, CH-2 is selected when RF SW pulse is "H" and CH-1 when "L", and it is output from pin ⑤.

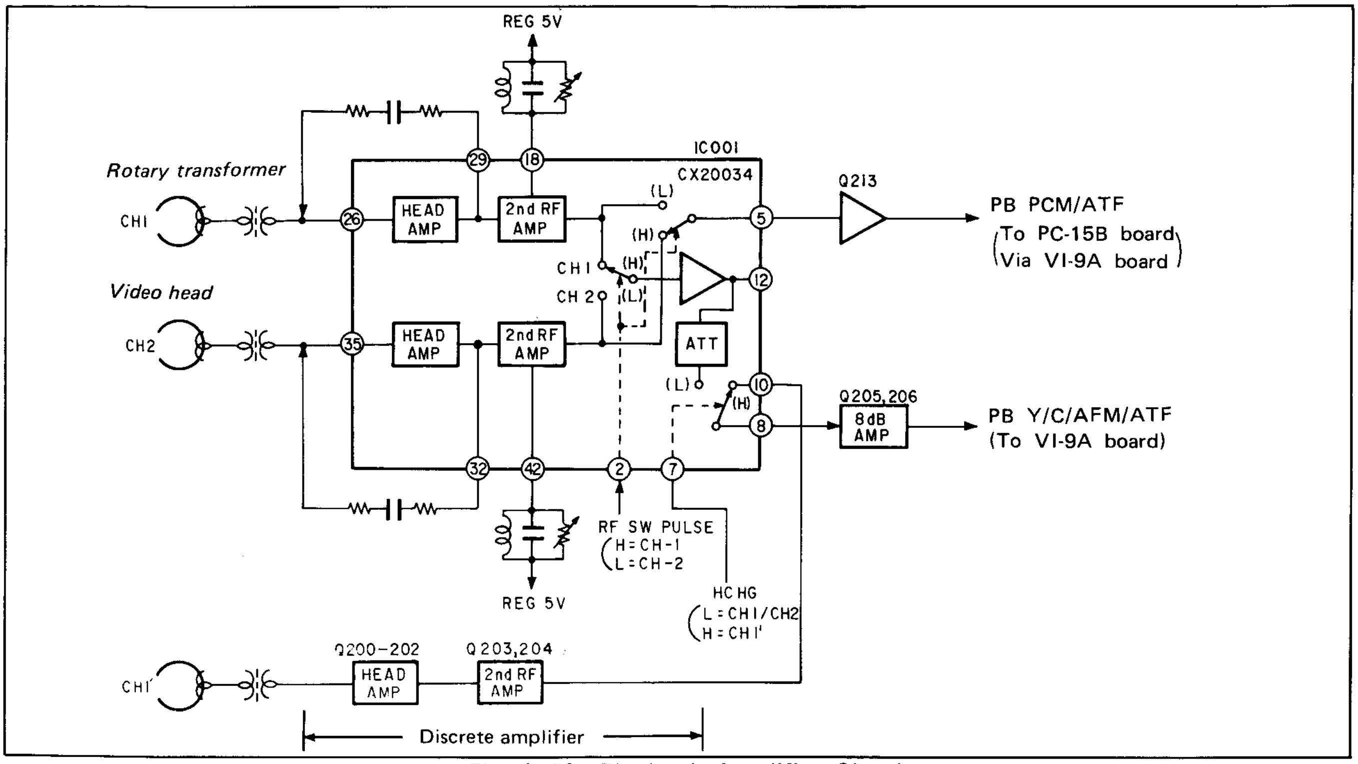


Fig. 2-19. Playback Amplifier Circuit

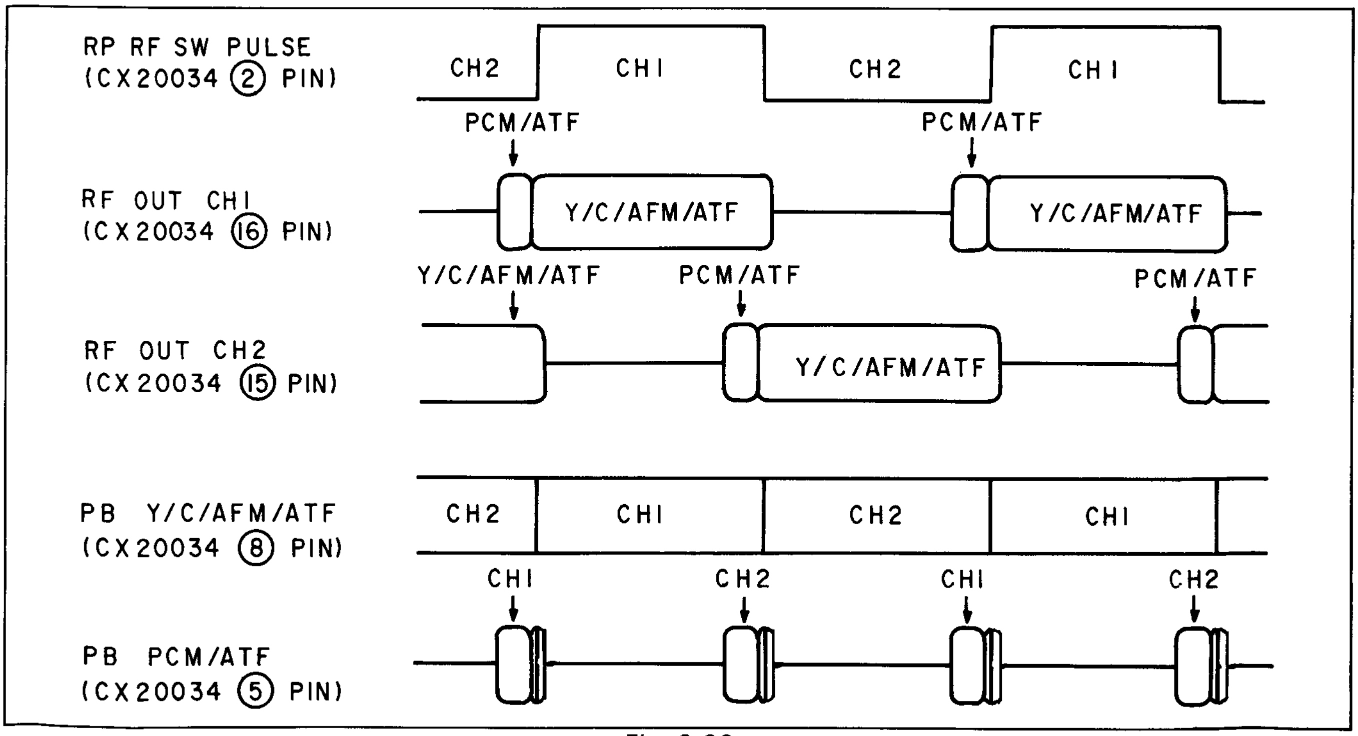


Fig. 2-20.

2. SOFT LIMITER (VI-9A BOARD, Q009, Q010, D003, D004)

For the purpose of preventing an inversion phenomenon caused by head output level fluctuations, only when the head output becomes low an upper side band zone is corrected by raising the Y-FM signal high frequency.

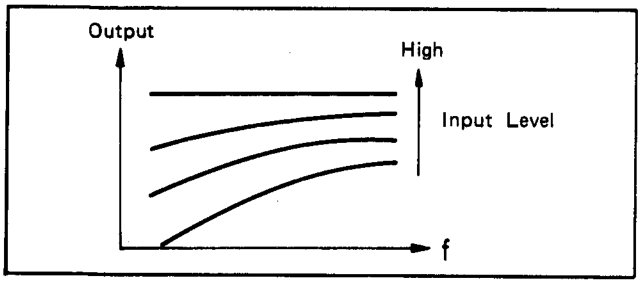


Fig. 2-21. Soft Limiter Characteristics

3. RF AGC (CX20130)

The output varies with the tape speed and the kind of tape. It stabilizes the DOC DET operations by making RF output level constant.

4. LIMITER (CX20130)

It eliminates the head output fluctuations and makes the level constant.

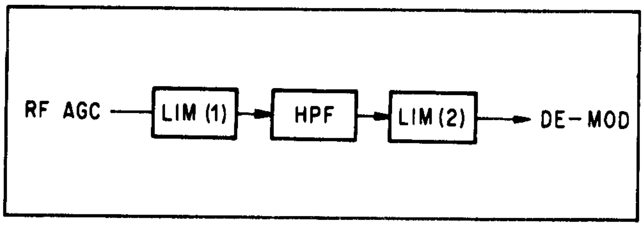


Fig. 2-22. Limiter Circuit (Inside IC)

When the output level composed of two steps is high, the limiter becomes a square waveform in the LIM (1). However, when the level is getting low, the LIM (1) works as a linear Amp. And it becomes a normal FM wave by emphasizing the high frequency by the HPF (high-pass filter) and is converted to a square wave form by the LIM (2).

5. FM DEMODULATION CIRCUIT (CX20130)

A multi-vibrator is used and when the Y-FM signal is added to a non-stable multi, the oscillation frequency locks to Y-FM signal and produces a fixed time lag.
The time lag is constant without relation to frequency.

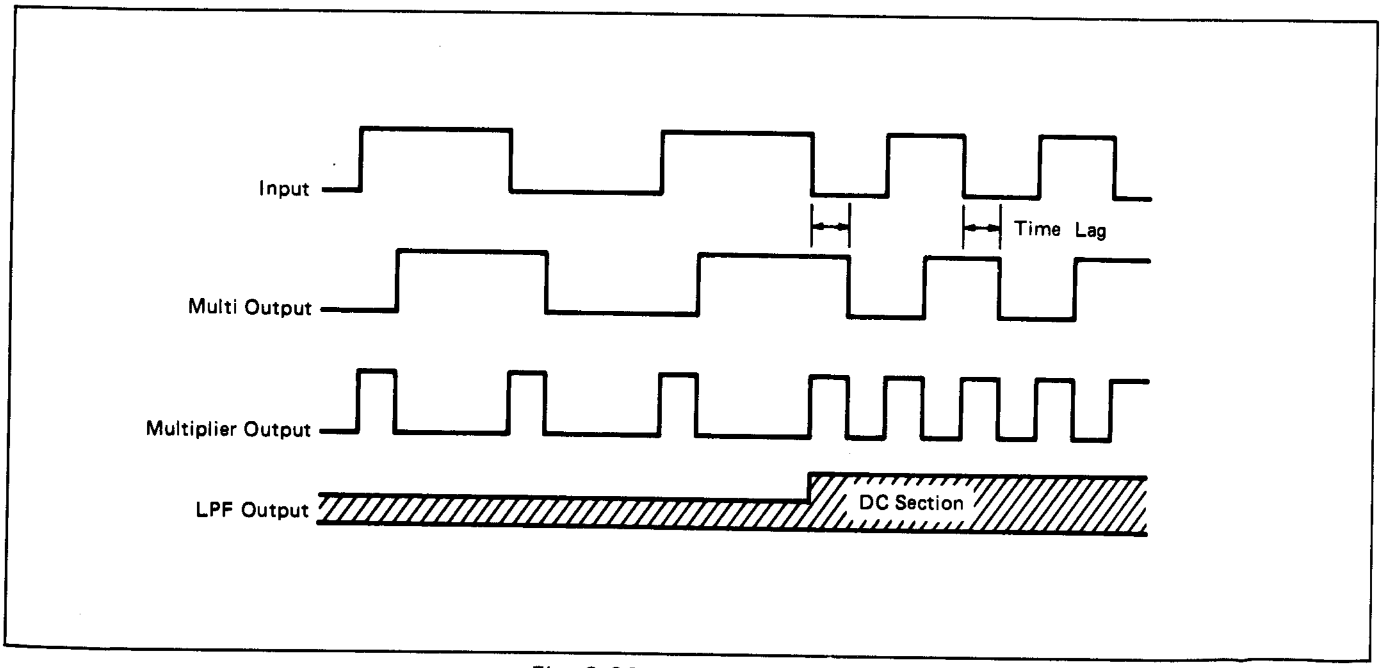


Fig. 2-23. FM Demodulator

6. DE-EMPHASIS CIRCUIT

The de-emphasis circuit lowers the high frequency component emphasized at the time of recording attenuates noise components.

The de-emphasis circuit consists of a main de-emphasis circuit, playback level adjustment, half H shift cancellation and Sub de-emphasis circuit.

In the main de-emphasis circuit, the linear de-emphasis is done, which is reverse to the characteristics at the time of recording. By converting the demodulation sensitivity of FM demodulator, the playback level adjustment makes it the non-linear de-emphasis to perform properly, which is the following step conducted by the Sub de-emphasis. It is because the non-linear de-emphasis can be different in the de-emphasis characteristics depending on the input level. The 1/2 fH shift cancellation corrects, by the RF SW pulse, the DC level difference which was produced by the 1/2 fH shift treatments every vertical period at the time of recording.

The Sub de-emphasis circuit is conducting the non-linear de-emphasis which is nearly reverse to the characteristics at the time of recording. If the exact reverse is done, on the contrary, the picture quality decreases due to the influences by the RF system frequency and phase characteristics.

[Main De-Emphasis Circuit]

By passing through the substraction Amp output in the HPF Amp having the same characteristics at the time of recording, and again by feeding it back to the negative side of the substraction Amp, the reverse characteristics at the time of pre-emphasis can be obtained (linear de-emphasis characteristics). For this purpose, the C, R of the Pin ⑲ , Pin ⑳ (these set the main de-emphasis characteristics at the time of playback) are just the same constants as the C, R of the Pin ㉓ , Pin ㉒ (these set the main emphasis characteristics). Since the de-emphasis characteristics also change with the HPF Amp gain, the same gain is set as the main emphasis HPF Amp at the time of recording by changing the Pin ㉔ voltage (which sets the gain of the main emphasis HPF Amp).

[Sub De-Emphasis Circuit]

By passing through the limiter and HPF Amp, the substraction circuit output having nearly the same characteristics as at the time of recording and again by feeding it back to the substraction circuit, the non-linear de-emphasis characteristics are obtained which are nearly the same as the reverse characteristics at the time of pre-emphasis. Sunce these limiter and HPF are used together with the sub-emphasis at the time of recording, it becomes the exact reverse characteristics if the C, R of Pin ㉗ and C, R between the Pin ㉖ , Pin ㉕ are the same constants at the time of recording. Actually, for the reason above mentioned, each C, R are changed over by the external transistor switch depending on the time of either recording or playback respectively. Furthermore, this is a substraction circuit because the feedback signal is phase-reversed by the limiter and HPF Amp.

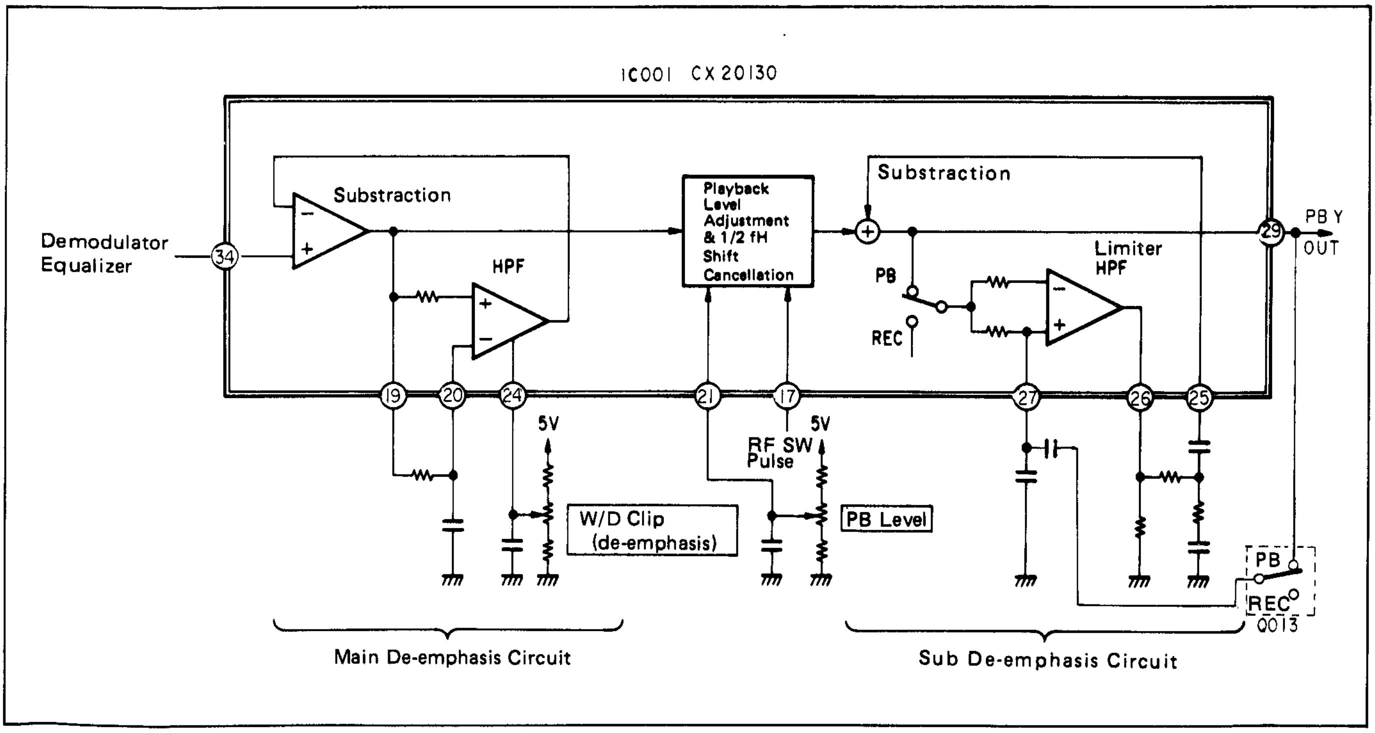


Fig. 2-24 De-Emphasis Circuit

7. SHARPNESS CONTROL

The correction of de-emphasis has been carried out to Q105 and Q106, and tuning expander is performed in the vicinity of the contour signal frequency of the picture.

Q110 performs sharpness control. The Y signal contour frequency component of the Q110 collector increases or decreases in accordance with RV601 of SS-38F/G board. This contour frequency component passes through L116 and C162 and is added to the Y signal of the Q110 emitter output, and thereby sharpness control is per formed.

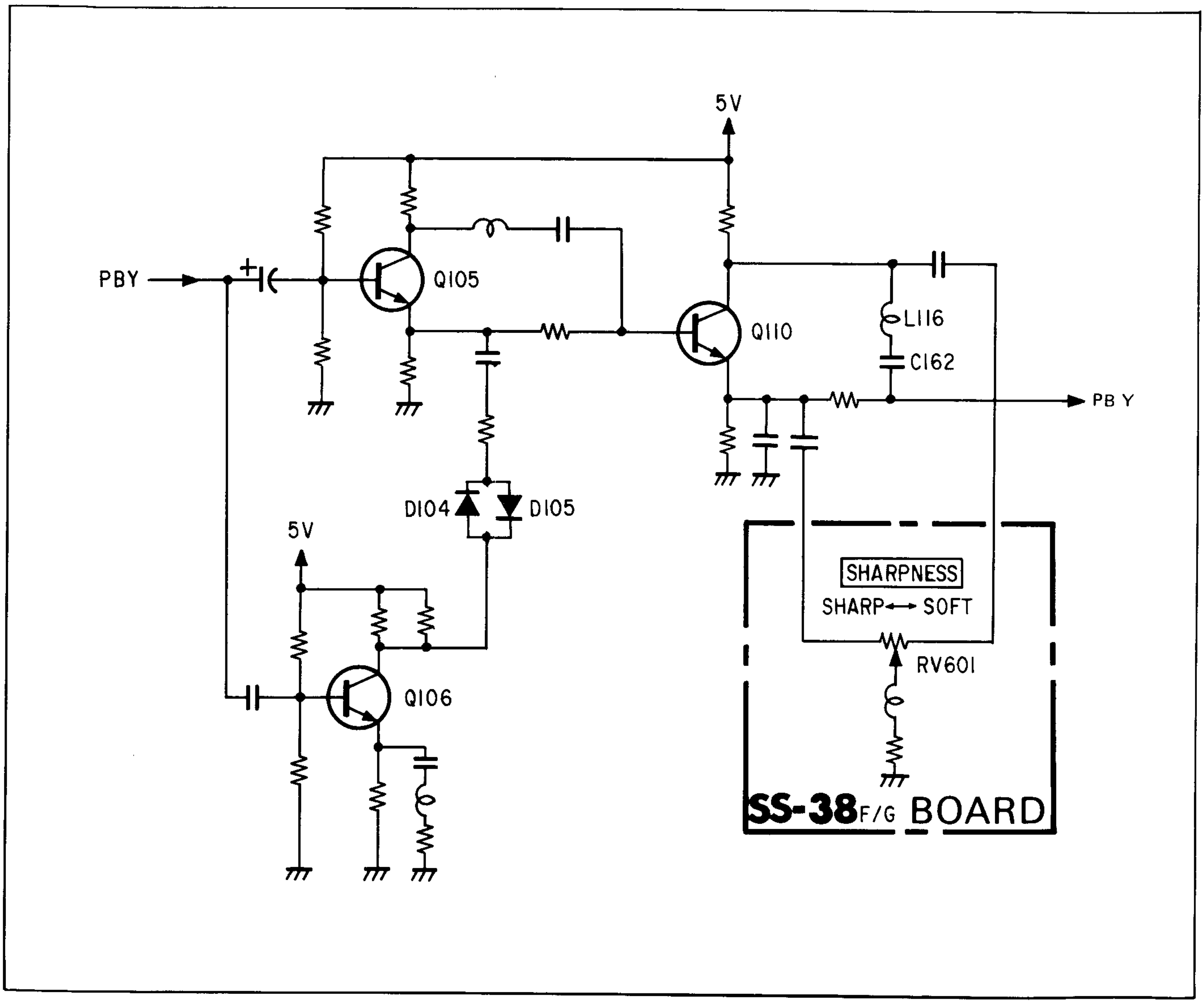


Fig. 2-25.

8. Y COMB FILTER (Cross-Talk Elimination)

Playback Y signal is offset between the CH–1 and CH–2 by 1/2 f_H, so it is interleaved with the cross-talk from the main signal and its adjacent track.

FEEDBACK TYPE DYNAMIC COMB-TYPE FILTER

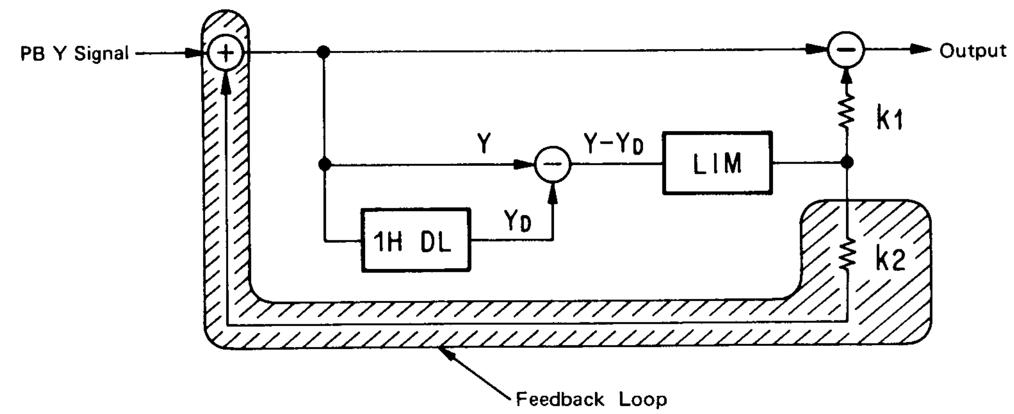


Fig. 2-26. Comb-Type Filter

[Without Feedback Loop]

With H-correlation, Y-Y_D becomes small and can pass through the limiter, but where there is no H-correlation Y-Y_D becomes very large and cannot pass through the limiter. In this case, the input signal outputs directly. For example, if $k_1 = \frac{1}{2}$, then output is Y-k_1 (Y-Y_D) = Y-$\frac{1}{2}$(Y-Y_D) = $\frac{1}{2}$(Y+Y_D), and the comb teeth effectiveness changes to accommodate the degree of correlation ...... This is called a dynamic comb-type filter.

[With Feedback Loop]

With H-correlation, Y-Y_D becomes small and can pass through the limiter, output being:

$$\frac{Y-k_1\,(Y-Y_D)}{Y+k_2\,(Y-Y_D)}$$

If we represent this graphically, we see that filter effectiveness increases with the strength of the correlation, with the comb teeth becoming sharper. When there is feedback overload, the high-frequency component is lost, as is the detail section.

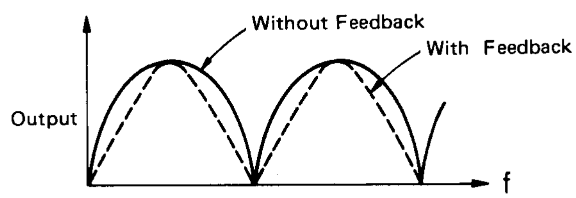


Fig. 2-27.

[Comb Tooth Valley Depth]

When the threshold level of the limiter is changed to make the limiter effective to a fine amplitude, Y-Y_D does not pass through the limiter unless correlation is strong. The comb teeth become shallow if correlation is weak, and crosstalk becomes more difficult to be removed. Conversely, when the limiter effectiveness is lowered, the limiter has a comb filter tooth characteristic even when correlation is weak, and crosstalk can be removed. However, information components are also removed.

8-1. Y Comb Filter Circuit

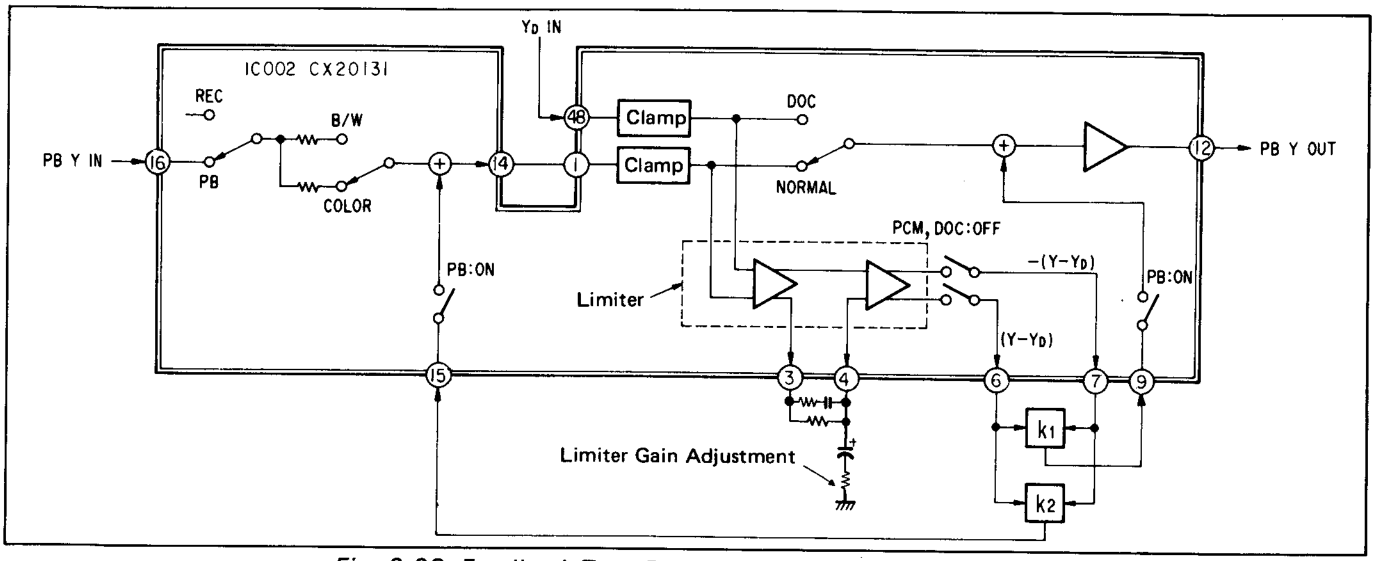


Fig. 2-28. Feedback Type Dynamic Comb Filter Circuit

The playback Y signal inputed at Pin ⑯ forms the dynamic comb filter with the Y-YD signal from Pin ⑨ , with the Y-YD signal from Pin ⑮ , forms the feedback loop, increasing the elimination rate of the crosstalk.

9. DROPOUT COMPENSATIONN

If dropout occurs, the detection pulse switches to SW and outputs a pre-1H signal. This switchover is carried out by means of the RF signal (pre-DE-MOD) or the post-DE-MODE video signal.

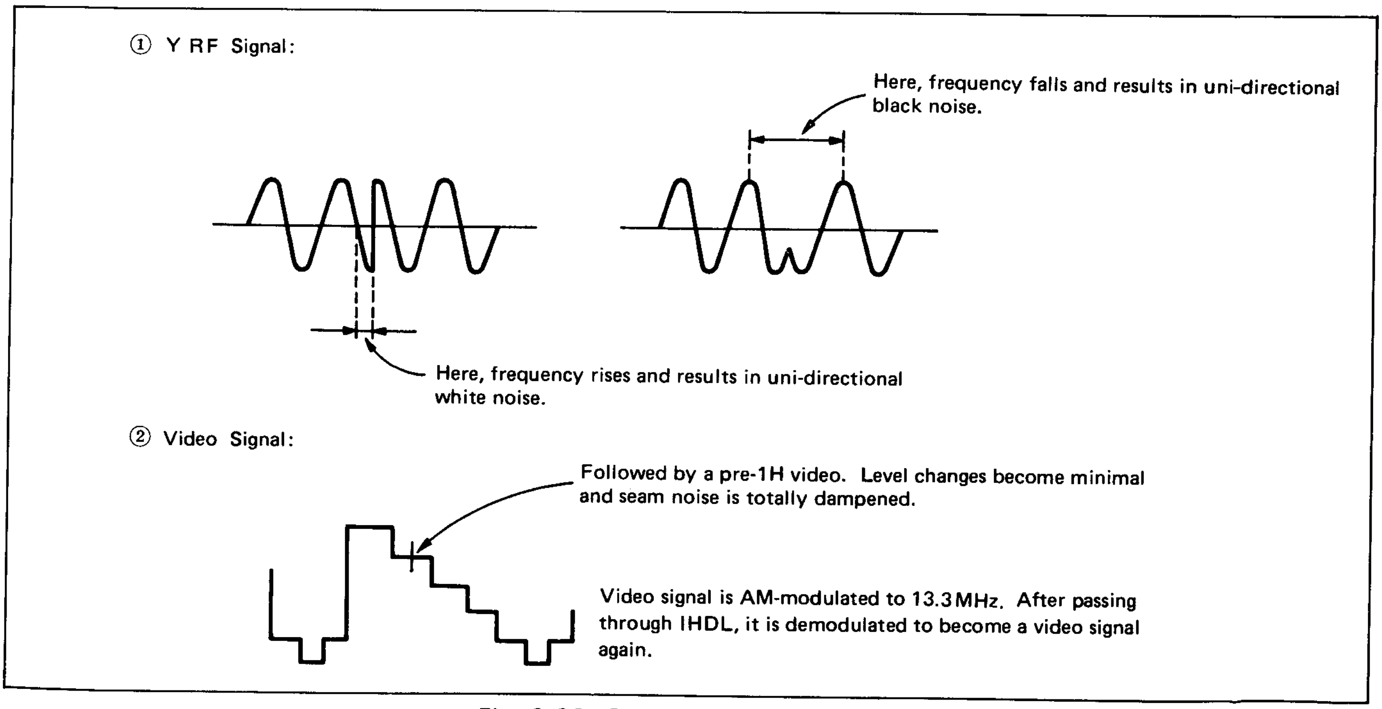


Fig. 2-29. Dropout Compensation

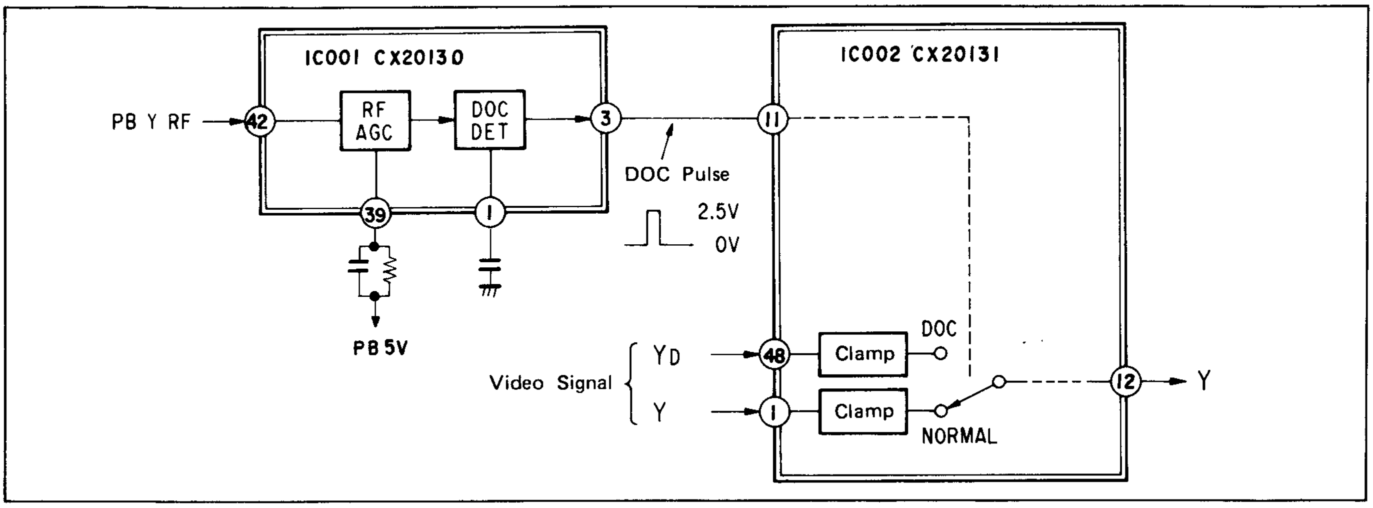


Fig. 2-30 Dropout Adjustment Circuit

After the playback Y-RF signal level difference has been stripped by the RF AGC circuit, it envelop-detects and detects dropout. When detection level is shallow, low-noise information can be gotten, but a signal like that shown in Fig. 2-31 will produce flutter. For this reason a hysteresis characteristic is built into the detection circuit.

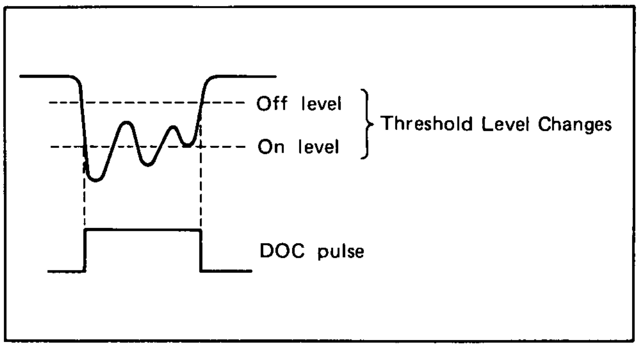


Fig. 2-31. Hysteresis Characteristic

10. VIDEO OUTPUT

Video output circuit is composed of the operation amplifier. IC applies DC feedback on it's inside and improves low-pass responsiveness. Once outside, the circuit sets up and AC feedback loop for gain control.

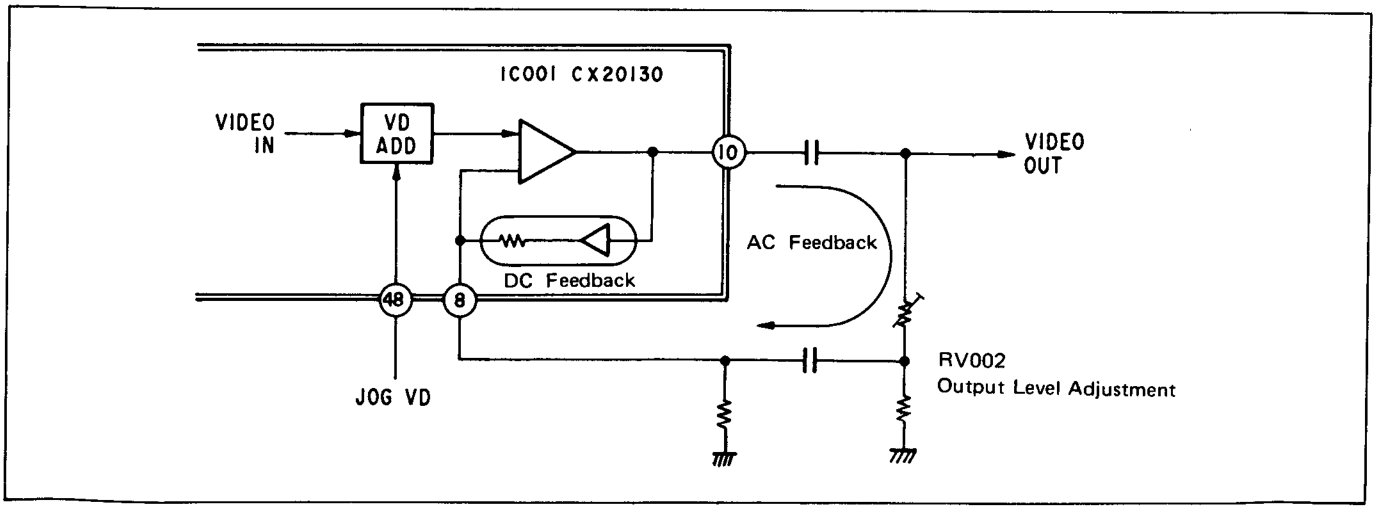
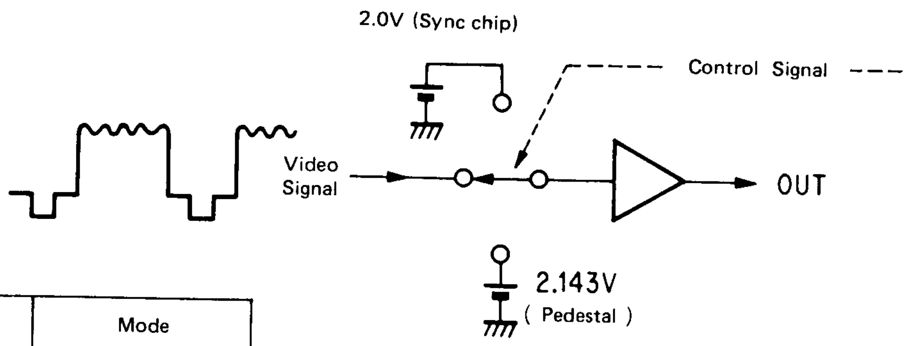


Fig. 2-32. Video Output Circuit

11. VD INSERTION

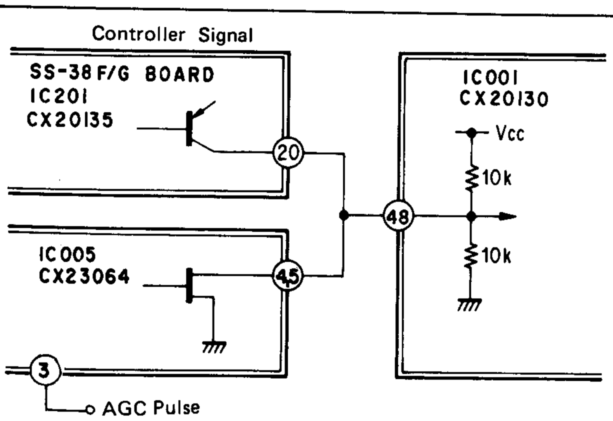
DC level replacement for Mute, VD insertion is by means of SW. Control is achieved by 3 state inputs to CX20130 Pin 48.



Pin 6	OUT PUT	Mode
H	2.0V (Sync chip DC level)	VD Insertion
HIZ	Video signal (SYNC TIP 2.0V)	Normal PB/E-E (color)
L	2.143V (Pedestal DC level)	MUTE, E-E Trap

Fig. 2-33 VD Insertion

12. CONTROL SIGNAL



AGC pulse is fed to CX20130 Pin 47 to perform AGC DET and clamp on VD input section.

Fig. 2-34 Controller Signal

The VD insertion during the Mute and Jog is performed by the CX20130 and the timing is prepared by the CX23064. By a split resistor within the internal IC a 2.5V current is retained and the input video signals are output without any change when Pin 48 is in the HIZ state. When Pin 48 is at L, the level is changed to the pedestal level and when it is H it is changed to the SYNC Tip level.

2-3. CHROMA SIGNAL RECORDING SYSTEM

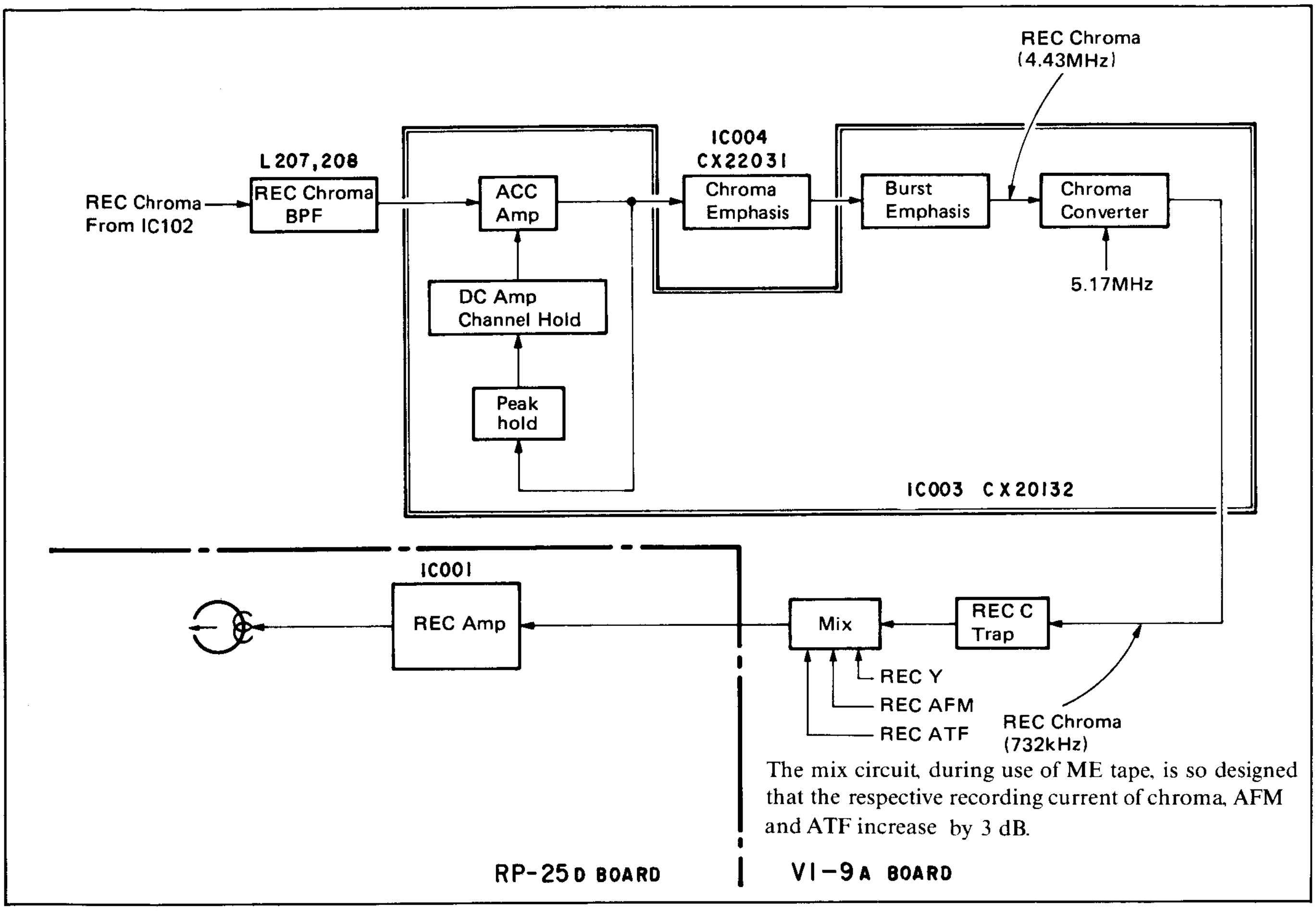


Fig. 2-35. Recording System Block Diagram

1. ACC CIRCUIT

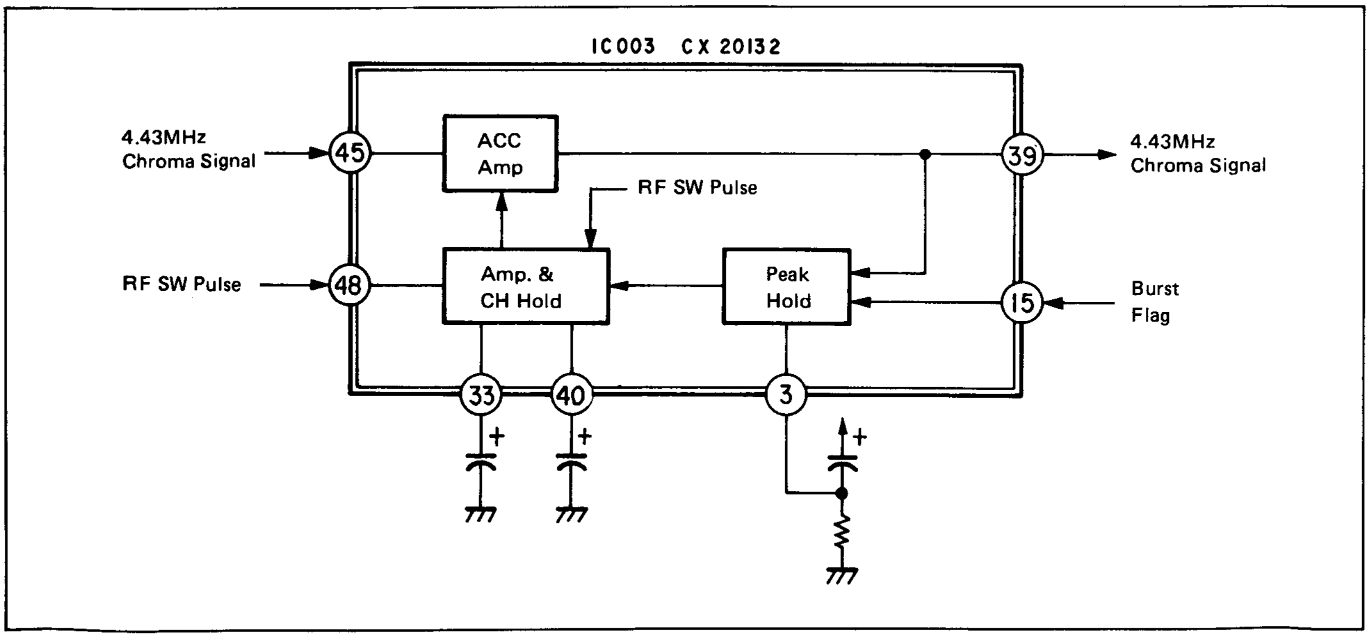


Fig. 2-36. ACC Circuit

The 4.43MHz chroma signal Y/C-separated by a bandpass filter (L207, L208) adjusts the chroma signal level to make the burst level constant by controlling the ACC Amp gain. The ACC loop is composed of the peak hold circuit, the DC Amp, and channel hold circuit.

[Peak Hold Circuit]

The peak hold circuit is composed of the burst gate circuit and peak detection circuit. The burst gate is an Amp that works only during the burst interval determined by the burst flag. Here it is picked out by the burst signal.

In the peak detection circuit, the peak level of the burst sampled by the burst flag is detected and held by the CR linked to the Pin③.

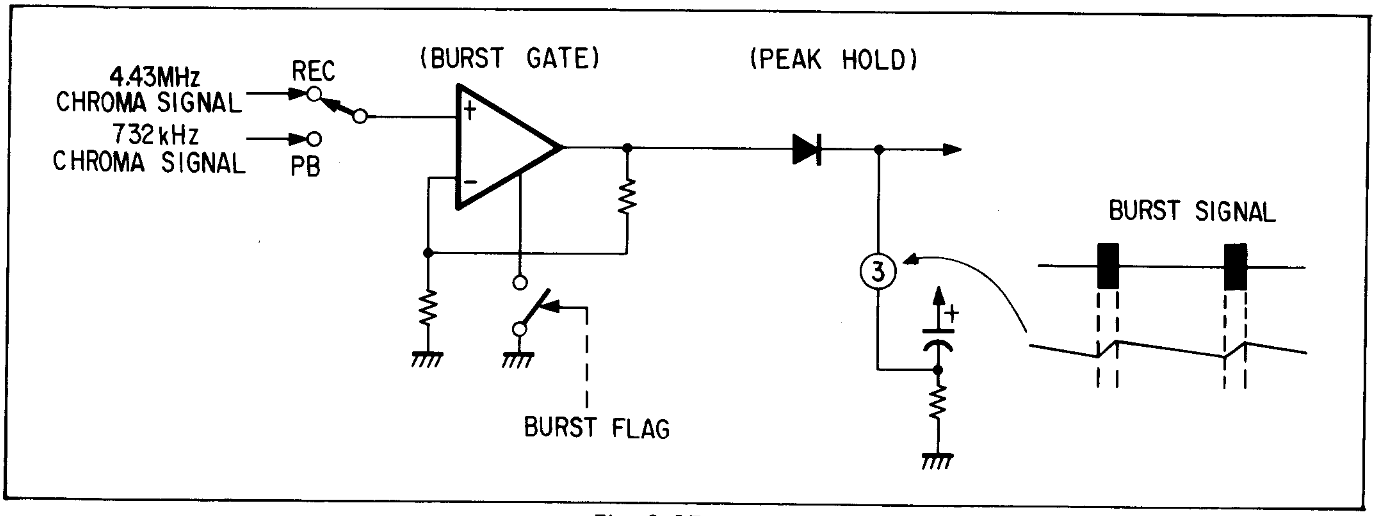


Fig. 2-37.

[Amp and Channel Hold Circuit]

Compares the output voltage of the peak hold circuit to a reference voltage, boosts and smoothens the difference, and controls the ACC Amp gain.

The RF SW pulse switches to a field smoothing capacitator which acts to adjust the video head sensitivity during playback.

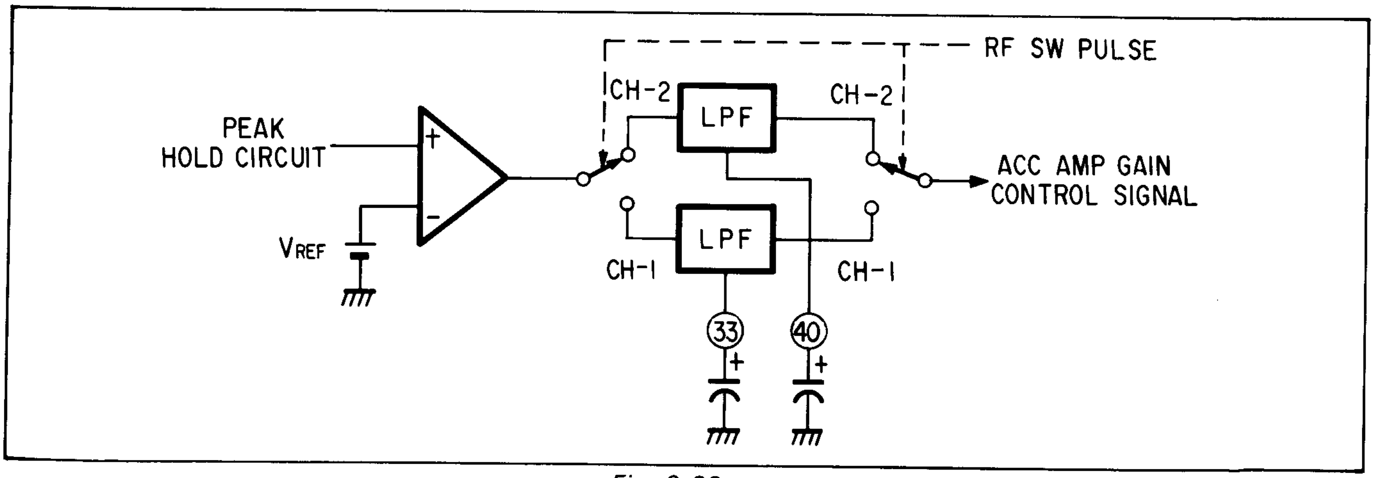


Fig. 2-38.

2. CHROMA EMPHASIS

Improves S/N by emphasis of chroma signal side band range during recording and de-emphasis of chroma side bands on playback.

The chroma signal side band range is susceptible to noise influence due to the small size of the spectrum component level.

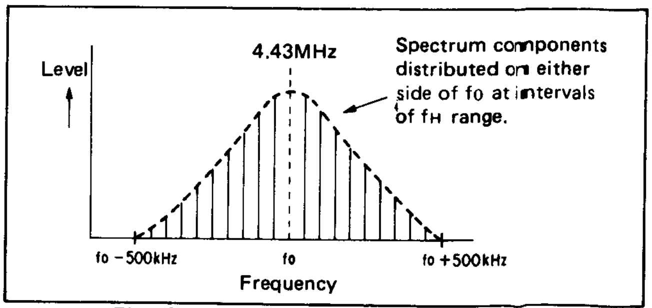


Fig. 2-39 Chroma Signal Spectrum

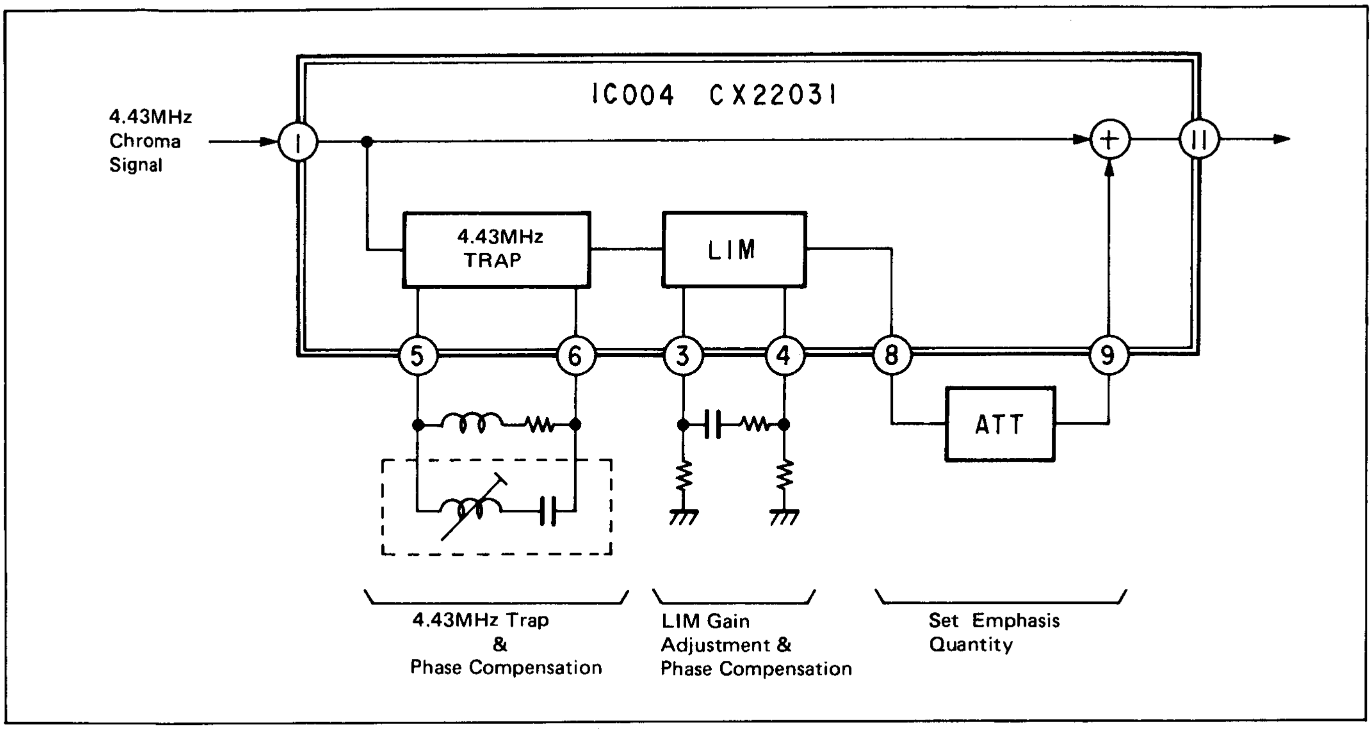


Fig. 2-40. Chroma Emphasis Circuit

In this circuit when the Chroma signal level is big the emphasis has no effect, when the level is decreased the emphasis quantity increases, the emphasis quantity is small near the subcarrier center and when it is moved away from the center the emphasis quantity increases. The side band components of the 4.43MHz chroma signal from Pin ① which is picked out at the 4.43MHz trap pass through the limiter and are added to the input signal. The limiter output level is not affected by the input Chroma signal level but is fixed according to the working of the limiter. Accordingly the emphasis quantity becomes non linear.

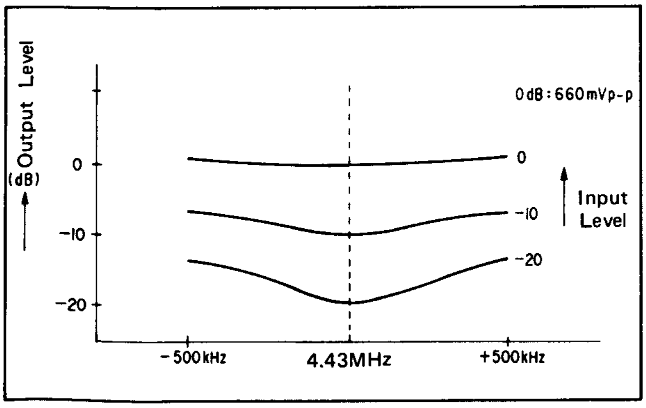


Fig. 2-41. Chroma Emphasis Characteristic

3. BURST EMPHASIS

The noise fed to burst signal is canceled to improve the S/N of chroma signal by making the burst level up when recording and returning to the original level when playback. The Burst emphasis circuit using the Burst flag, gains a higher number of Amps during the Burst time.

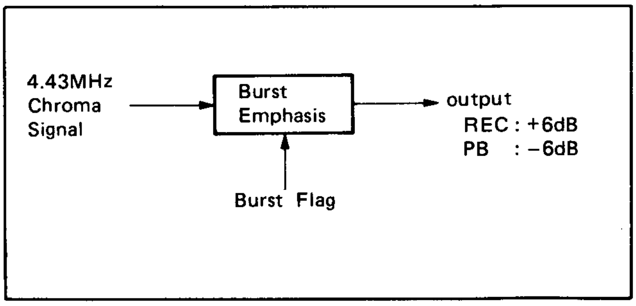


Fig. 2-42. Burst Emphasis

4. FREQUENCY CONVERTER CIRCUIT

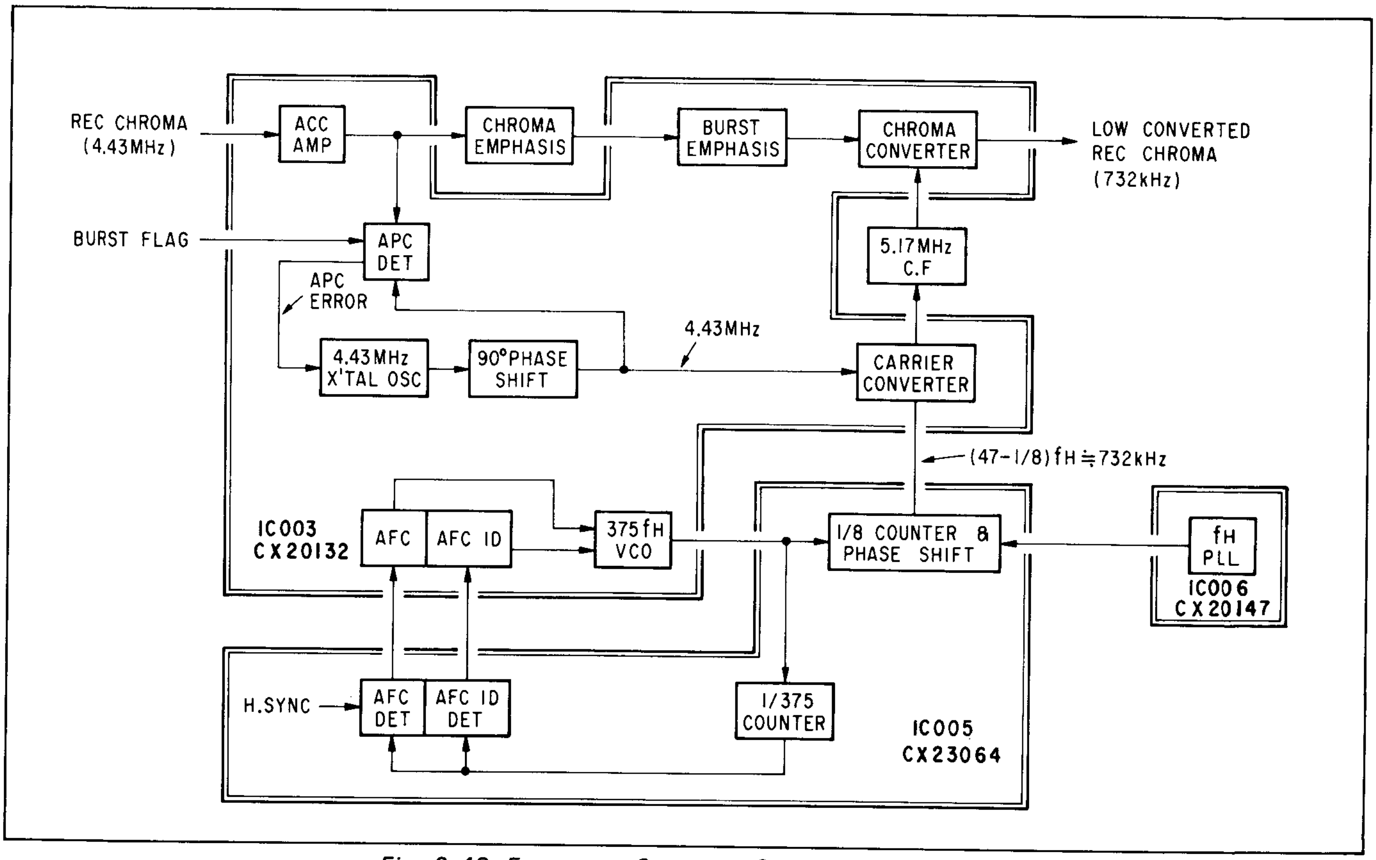


Fig. 2-43. Frequency Converter System Block Diagram

The frequency converter system on recording section is composed of the frequency converter circuit, AFC circuit and the APC circuit. The Frequency converter system changes the 4.43 MHz Chroma signal to 732 kHz Chroma signal.

Frequency Conversion System

- ∘ Frequency Converter Circuit
  - ∘ Carrier Converter:
    A 4.43MHz signal from APC circuit and a 732kHz signal from AFC circuit are converted into a 5.17MHz signal.
  - ∘ Chroma Converter:
    The 4.43MHz Chroma signal is converted to the 732kHz Chroma signal.
- ∘ AFC Circuit .... A 732 kHz [(47−1/8) fH] signal which was phase-locked with H. SYNC separated from the input video signal.
- ∘ APC Circuit .... A 4.43MHz signal, phase locked with the Burst signal which is separated from the input video signal, is composed.

4-1. AFC Circuit

AFC circuit during recording is producing $(47-\frac{1}{8})\cdot f_H$ (approximately 732kHz) signal which is phase-locked to H.SYNC signal separated from input video signal.

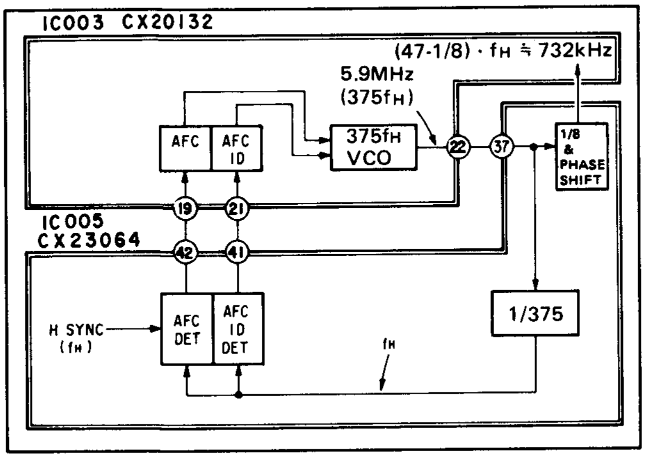


Fig. 2-44. AFC Circuit

AFC circuit is composed of IC003 and IC005. The output of $375\cdot f_H$ VCO converted to frequency f_H by 1/375 frequency divider is fed to AFC detection circuit and AFC ID. AFC detection circuit also receives H.SYNC signal and makes a phase comparison with these two signals.

Phase error signal transmitted from Pin 42 in the form of trinary digital signal contributes to phase-locking of $375\cdot f_H$ VCO to H.SYNC signal. $375\cdot f_H$ VCO output, which is phase-locked to H.SYNC signal by this AFC loop, is fed to carrier converter after a cycle of $375\cdot f_H$ VCO output is devided into 8 parts and performed phase shift. AFC IC circuit does not activate while AFC is being phase-locked, but does only when the phase-locking is unlocked. Besides, IC005 is C-MOS type digital IC, and processes signals digitally. $375\cdot f_H$ VCO signal of IC003 is adopted as clock signal of AFC and APC.

[Reformation of $375\cdot f_H$ Signal Waveform]

$375\cdot f_H$ VCO output of IC003, which is as low as 0.5Vp-p, is amplified to 5Vp-p and reformed as to its waveform between Pin 37 and Pin 38 of IC005 in order to adjust to the logic level of IC005.

[1/375 Frequency Dividor]

This Frequency dividor is variable one so as to be applicable to other systems (e.g., NTSC). 1 cycle of frequency division counter is divided into 47 periods (M1T to M47T). One period (M2T) of these is divided into 7 and of the remaining 46 periods (M1T and M3T to M47T) each one is divided into 8. Consequently, $\frac{1}{1 \times 7 + 46 \times 8} = \frac{1}{375}$ is established.

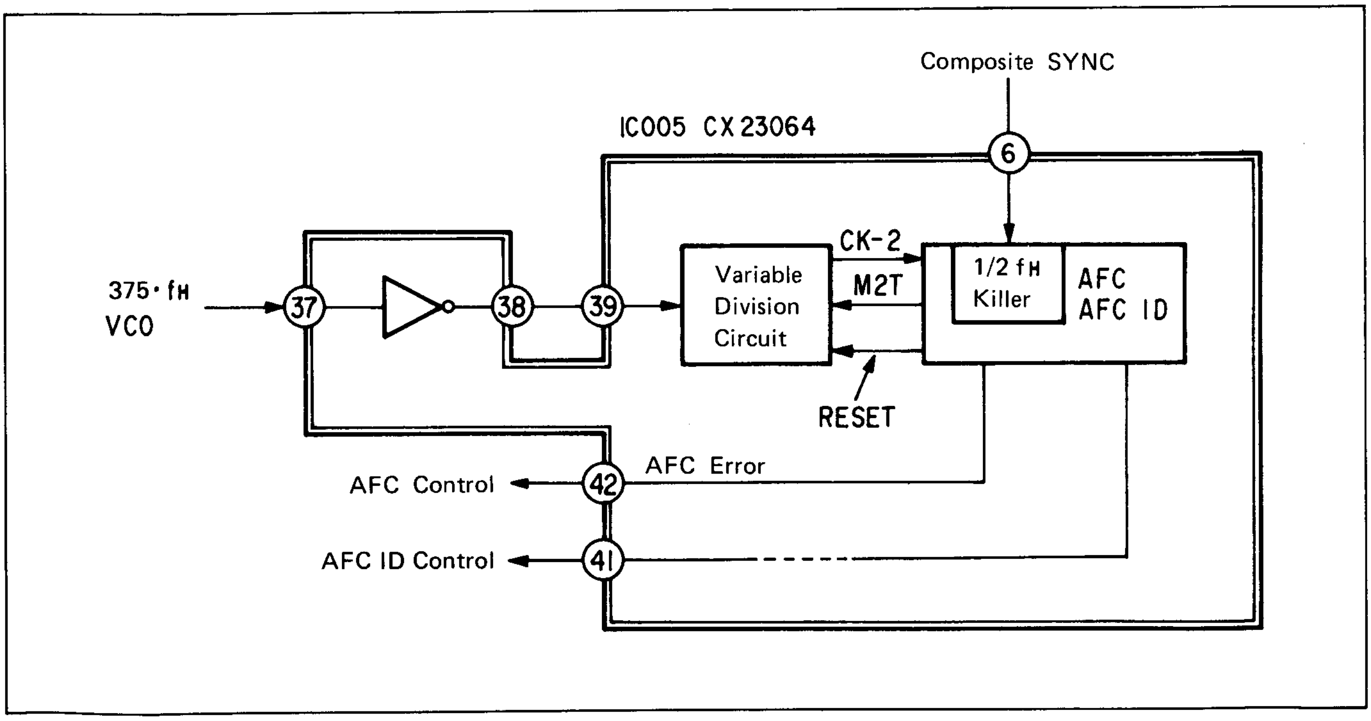


Fig. 2-45. 1/375 Division Circuit

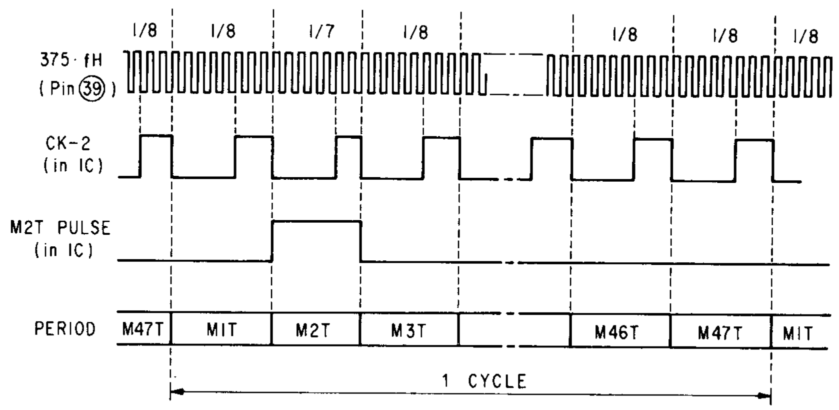


Fig. 2-46. 1/375 Division Timing Chart

[1/8 Frequency Division and Phase Shift Circuit]

1/8 frequency division and phase shifting are processed simultaneously. These processes shift the phase of 732kHz carrier 90° per H when the CH-1 head is being used (when the level of the RF SW pulse is "H").
This operation produces similar phase shift as in the low frequency conversion chroma signal also.

By recording the phase-shift processed chroma signal and by resetting phase shift processing during playback, the phase of the crosstalk component in the playback chroma signal turns every 2H, and the crosstalk component can be removed by the comb-type filter which uses a 2H delay line.

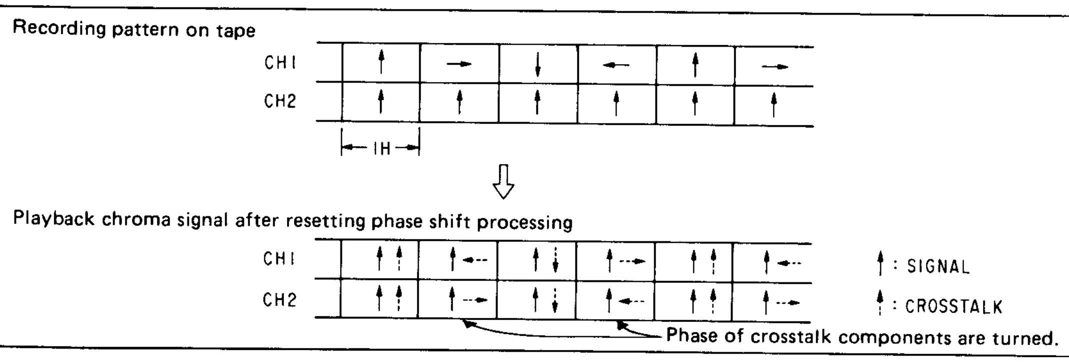


Fig. 2-47.

The phase shift timing is controlled by the H synchronous pulse produced by the fH PLL circuit inside IC006 to prevent maloperation by noise, etc.

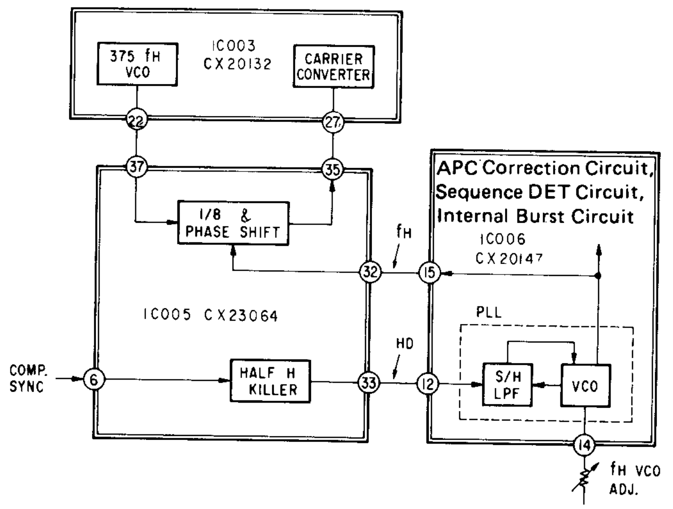


Fig. 2-48.

[AFC Detector]

By comparing the phase between H.SYNC rise and M24T period of 1/375 dividor output, AFC error signal is output at Pin ㊷ . AFC error signal is output in response to the phase difference as follows:

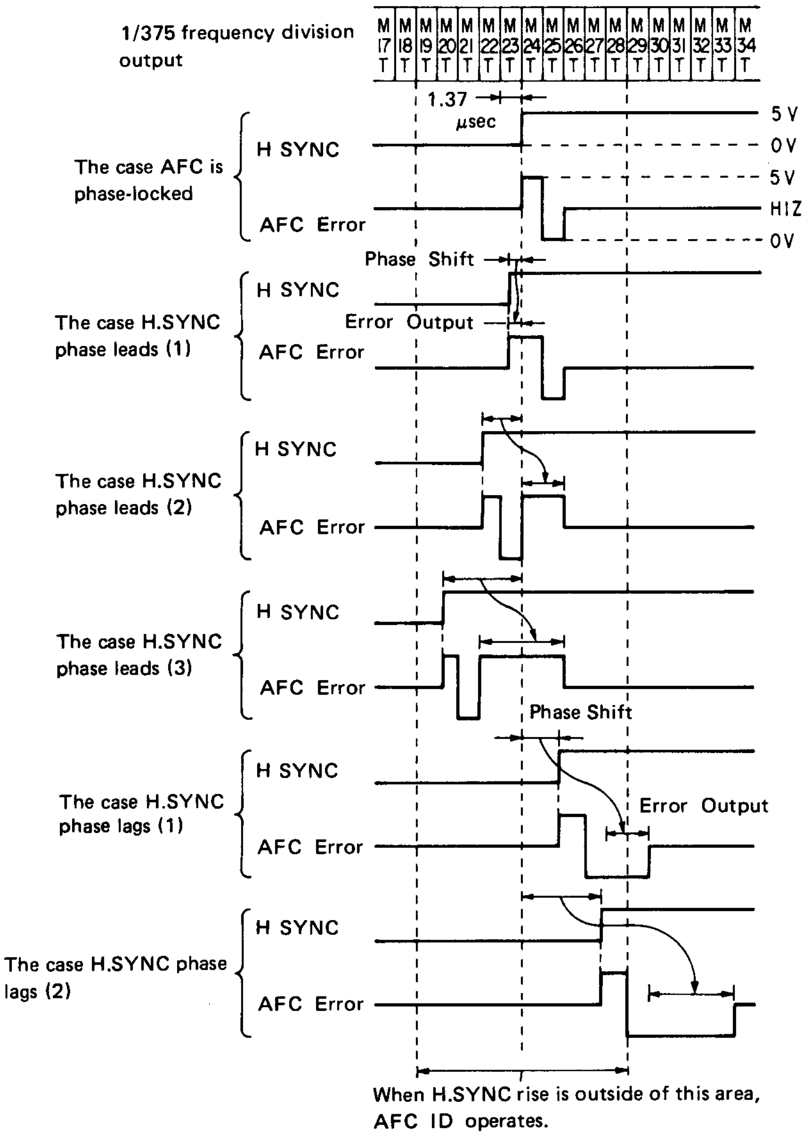


Fig. 2-49. AFC Timing Chart

[AFC Error Signal]

The pulse of the signal is output at 1H period so that the interference to picture is prevented by being synchronized to H. SYNC signal.

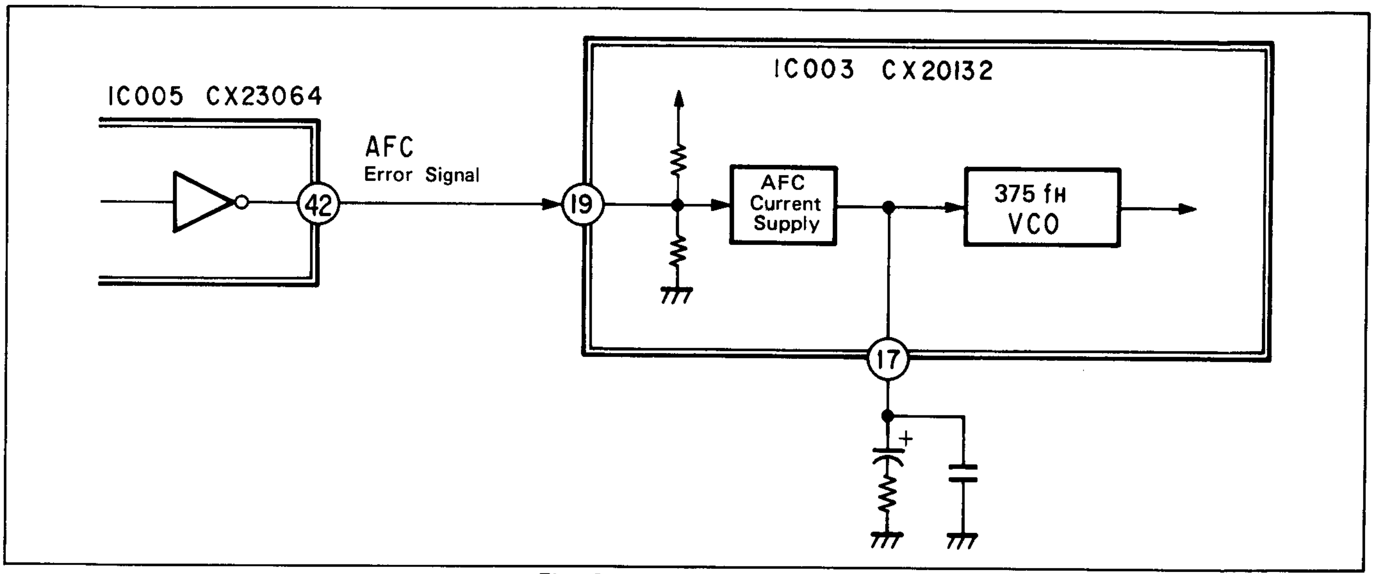


Fig. 2-50. AFC Interface

Error signal is a trinary output.

When H (5V) is output,
error signal activates AFC current supply connected to pin ⑲ of IC003 and discharges the capacitor at pin ⑰ . Consequently, if this period of time is prolonged more, then the voltage at pin ⑰ is reduced in proportion.

When L (0V) is output,
error signal activates AFC current supply connected to pin ⑲ of IC003 and charges the capacitor at pin ⑰ . Consequently, if this period of time is prolonged more, then the voltage at pin ⑰ increases in proportion.

When HIZ (high impedance) is output,
Pin ㊷ of IC005 becomes open. At this moment, pin ⑲ of IC003 is held at 2.5V by the split resistor in the IC. The AFC current supply does not operate and the voltage at pin ⑰ remains as it has been.

[375·fH VCO Control Signal]

375·fH VCO control voltage will be given by integrating AFC error signal by AFC current supply in IC003 and the capacitor at pin ⑰ .

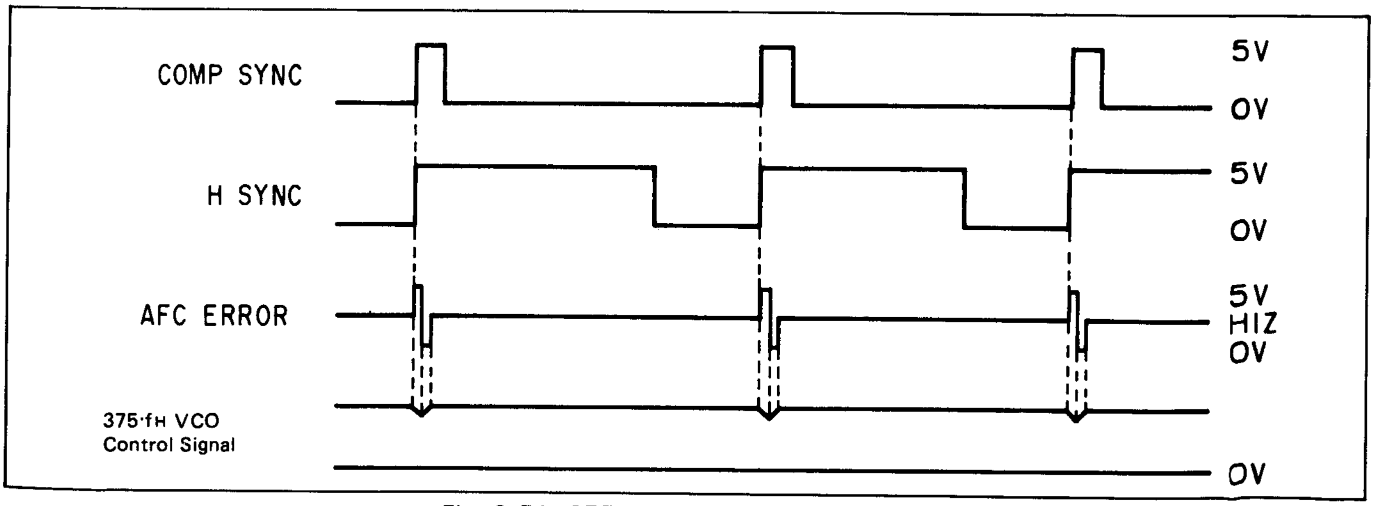


Fig. 2-51. 375·fH VCO Control/Timing Chart

In case "H" period of AFC error signal is longer than the "L" period i.e., H.SYNC signal is leading 1/375 frequency division signal, VCO control voltage is reduced, resulting in the rise of VCO oscillation frequency, the advancement of 1/375 division signal phase and the compensation for the difference with H.SYNC signal, and vice vers a.

[AFC ID Detector]

AFC ID operates when H.SYNC signal rise is not within M19T to M28T of 1/375 frequency dividor.

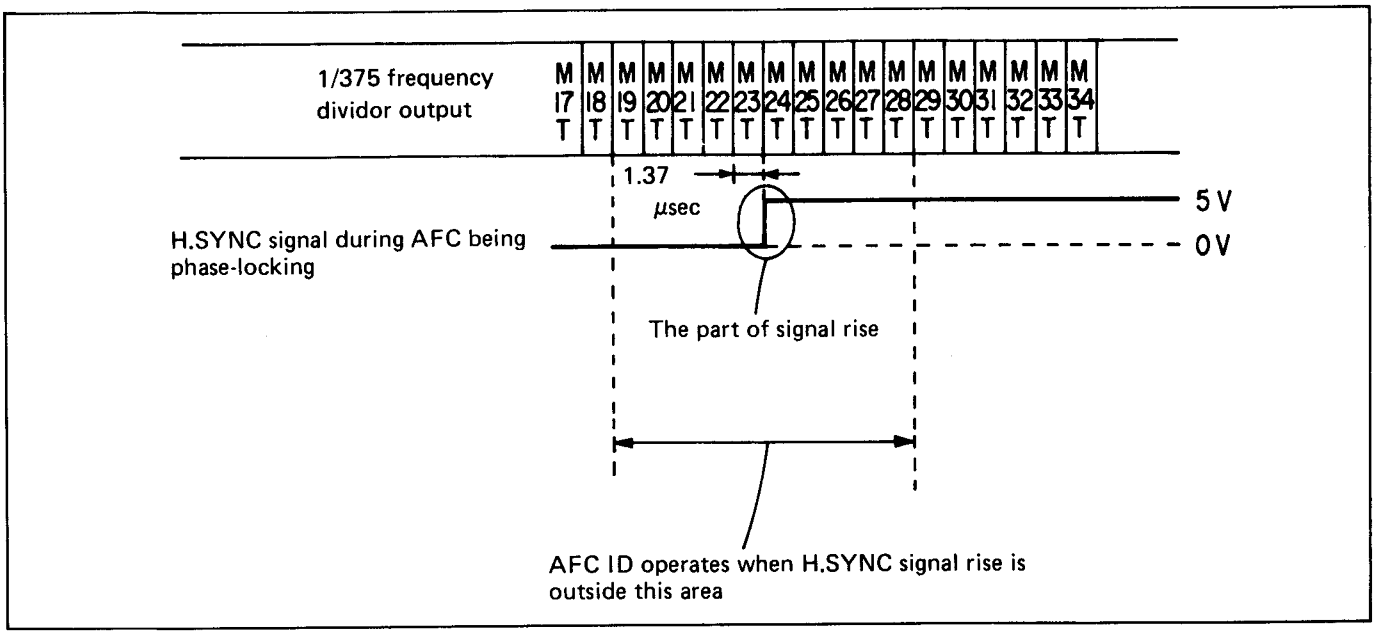


Fig. 2-52. AFC ID Operation Area

AFC ID signal is a trinary output.

- When H.SYNC signal rise comes within M19T to M28T, AFC ID signal becomes HIZ (high impedance).
- When H. SYNC signal rise shifts to M18T side, AFC ID signal becomes "H" (5V) during 1H and turns up the VCO oscillation frequency.
- When H. SYNC signal rise moves toward M29T side, AFC ID signal is "L" (0V), turning down the VCO oscillation frequency.

[AFC ID/APC ID Interface]

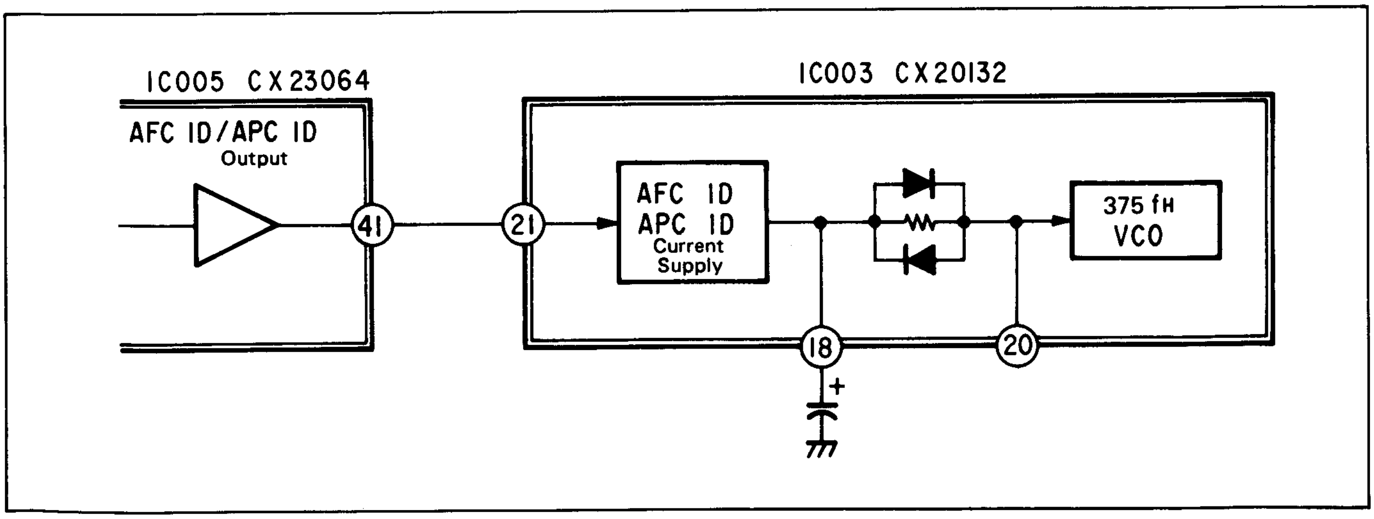


Fig. 2-53. AFC ID/APC ID Interface

AFC ID signal is integrated by AFC ID current supply at pin ㉑ of IC003 and capacitor at pin ⑱ . The voltage produced at pin ⑱ is fed to 375·fH VCO after passing through the blind zone added circuit configurated by diodes between pin ⑱ and pin ⑳ .

Blind zone: is so designed as to make 375·fH VCO free from responding to short period AFC ID signal (less than 10 AFC ID pulses).

[Half H Killer Circuit]

H.SYNC signal is used for AFC, AFC ID (for recording) and APC ID (for playback) as comparing signal. This H.SYNC signal is produced by composite SYNC separated from input video signal. It is necessary to eliminate the equivalent pulse of 1/2H period included in vertical synchronizing signal in COMP SYNC signal. Half H killer circuit in IC005 using a flip-flop is set at the COMP SYNC signal rise and is locked simultaneously to M25T period of 1/375 dividor output by AFC (during recording) and APC (during playback). It will be reset at M11T period. Consequently, it is kept set for approximately 45μsec.

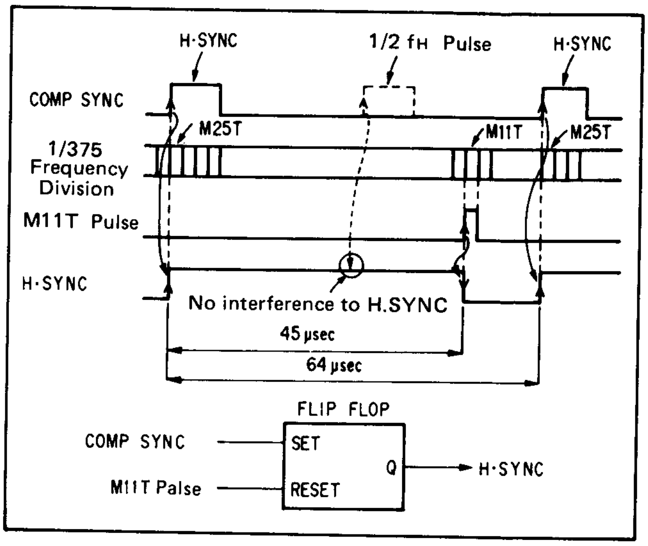


Fig. 2-54. Half H Killer Timing Chart

4-2. APC CIRCUIT

While recording, APC circuit is producing 4.43MHz signals phase-locked to the average phase of burst signal in chroma signal.

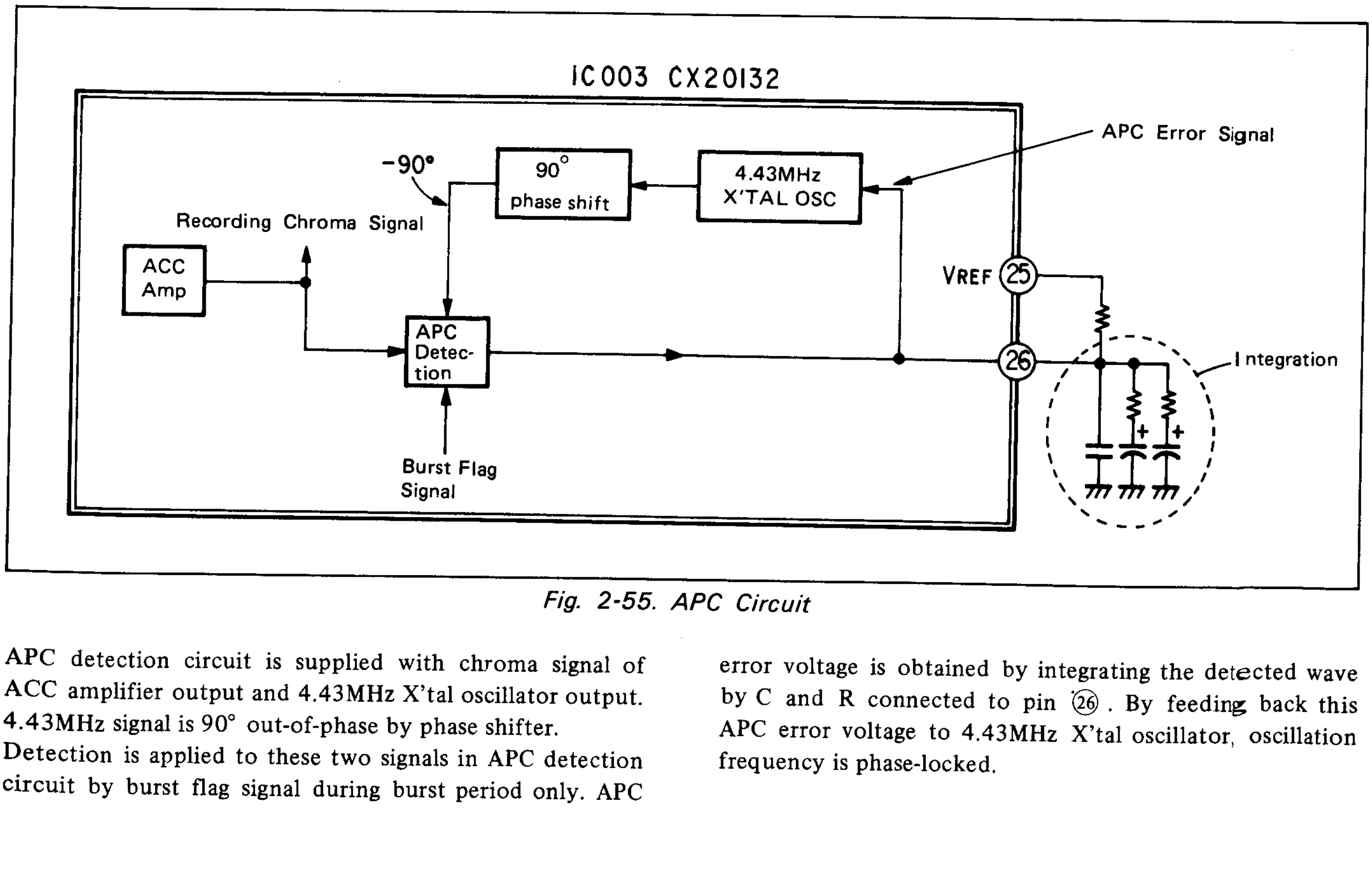


Fig. 2-55. APC Circuit

APC detection circuit is supplied with chroma signal of ACC amplifier output and 4.43MHz X'tal oscillator output. 4.43MHz signal is 90° out-of-phase by phase shifter. Detection is applied to these two signals in APC detection circuit by burst flag signal during burst period only. APC error voltage is obtained by integrating the detected wave by C and R connected to pin ㉖. By feeding back this APC error voltage to 4.43MHz X'tal oscillator, oscillation frequency is phase-locked.

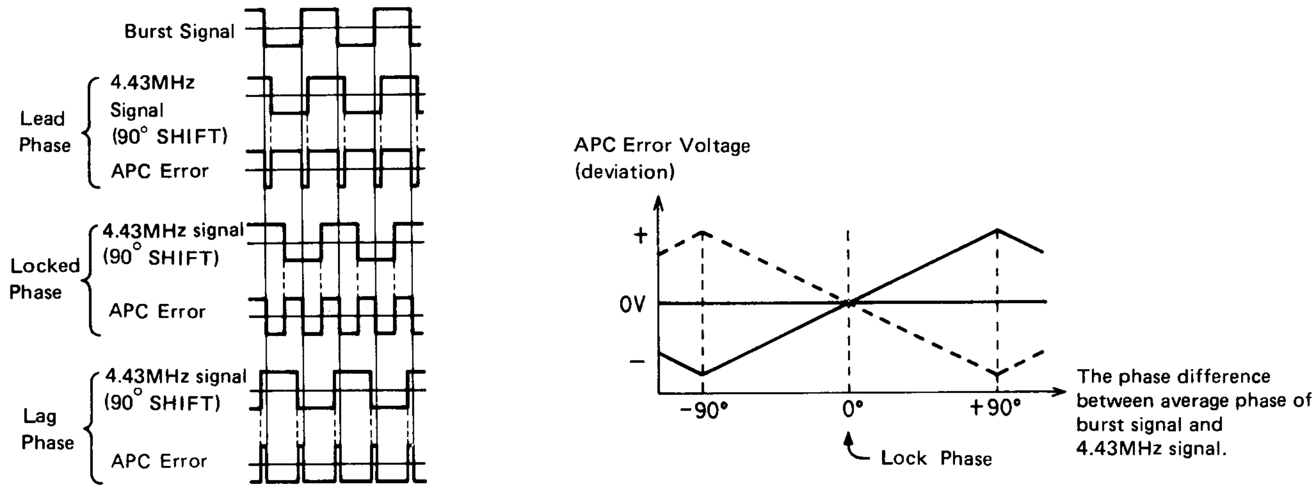


Fig. 2-56. APC Detection Timing Chart

4-3 CARRIER CONVERTER CIRCUIT

Carrier for frequency conversion is being produced by (47-⅛) f_H (approximately 732kHz) signal made in IC005 and 4.43MHz signal generated in IC003. Simultaneously the spurious signal is eliminated through the ceramic filter.

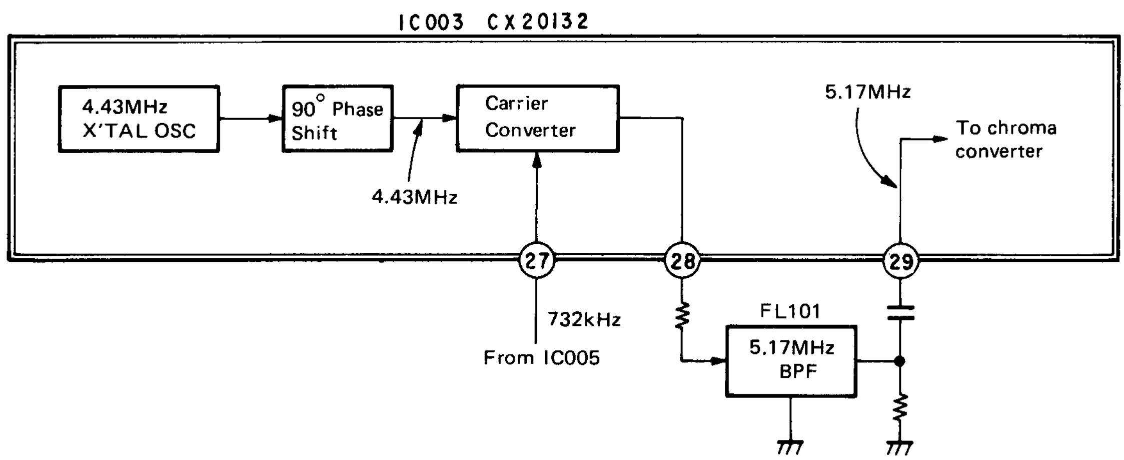


Fig. 2-57. Carrier Converter Circuit

4-4. CHROMA CONVERTER

4.43MHz (fsc) chroma signal is converted into 732kHz ((47-1/8)f_H) chroma signal by frequency conversion carrier of 5.17MHz (fsc+(47-1/8)f_H). REC chroma trap removes the spurious element (9.6MHz) generated simultaneously.

This trap composed of BPF of 732kHz ±500kHz and 1.5 MHz trap. The former eliminetes chroma signal element in Y-FM signal band and ATF signal band, the latter removes chroma signal element in AFM band.

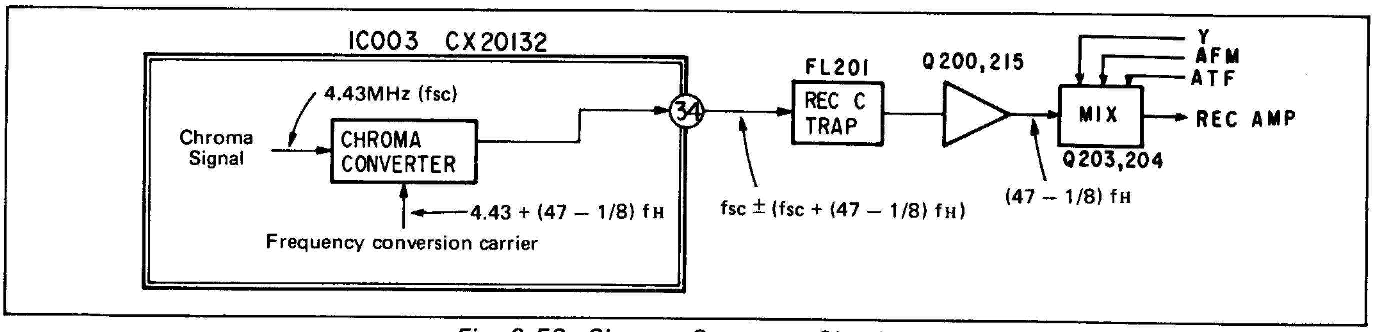


Fig. 2-58. Chroma Converter Circuit

2-4. CHROMA SIGNAL PLAYBACK SYSTEM

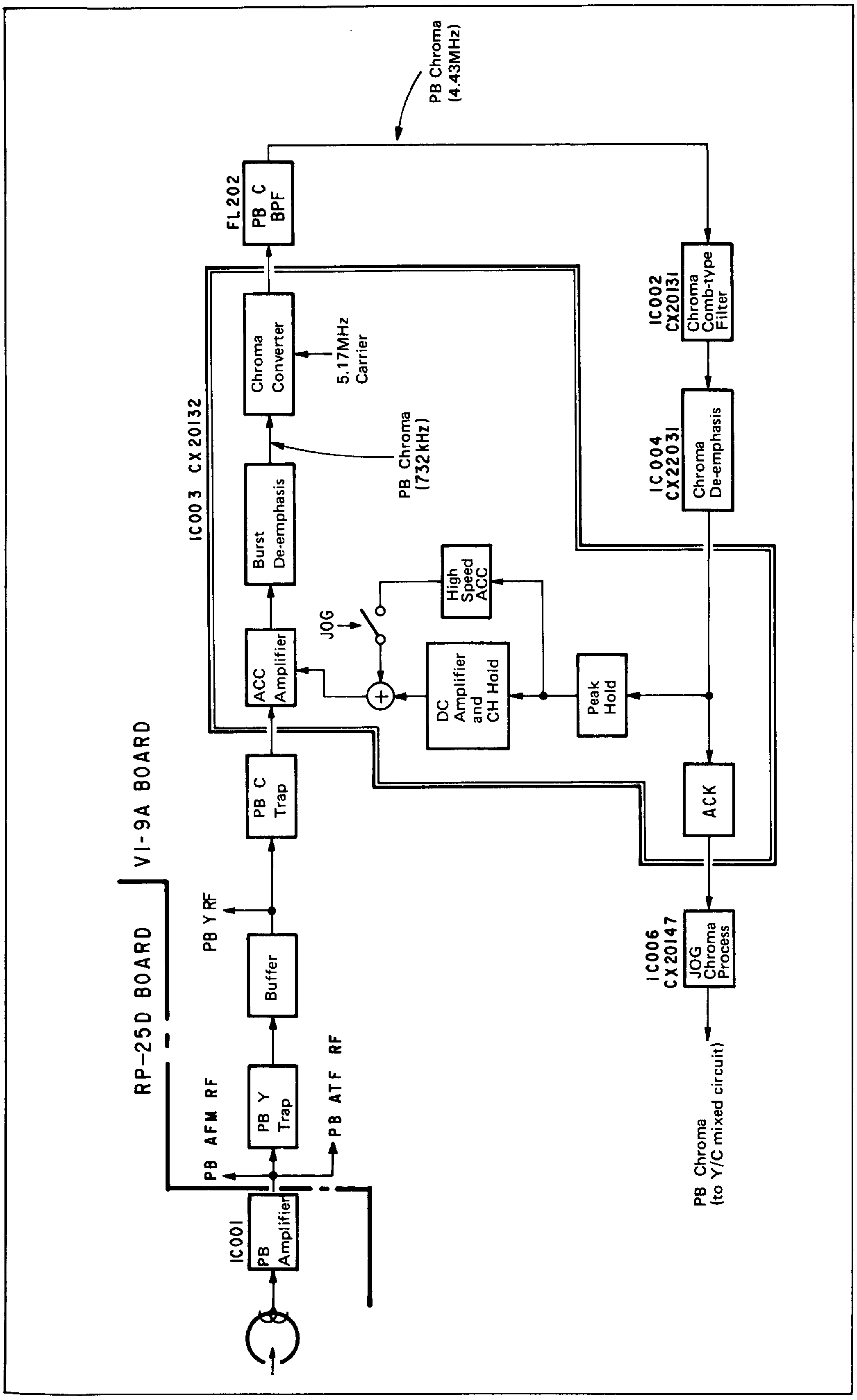


Fig. 2-59. Playback System Block Diagram

1. PLAYBACK CHROMA TRAP

Playback chroma trap picks out playback chroma signal by eliminating Y-FM signal, AFM signal and ATF signal from playback RF signal.

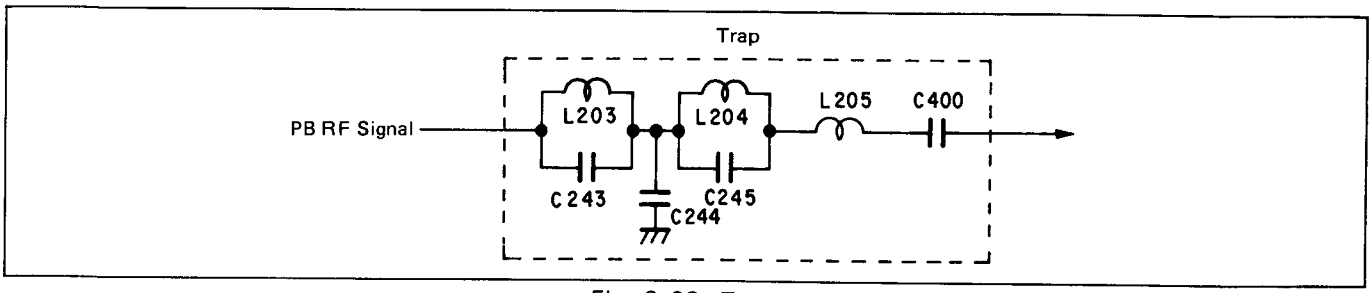


Fig. 2-60. Trap

2. ACC AMPLIFIER

ACC amplifier during playback has the following two functions.

1. Elimination of level fluctuation of playback chroma signal.
2. Elimination of level difference of playback chroma signal of each channel caused by the sensitivity difference of video head.

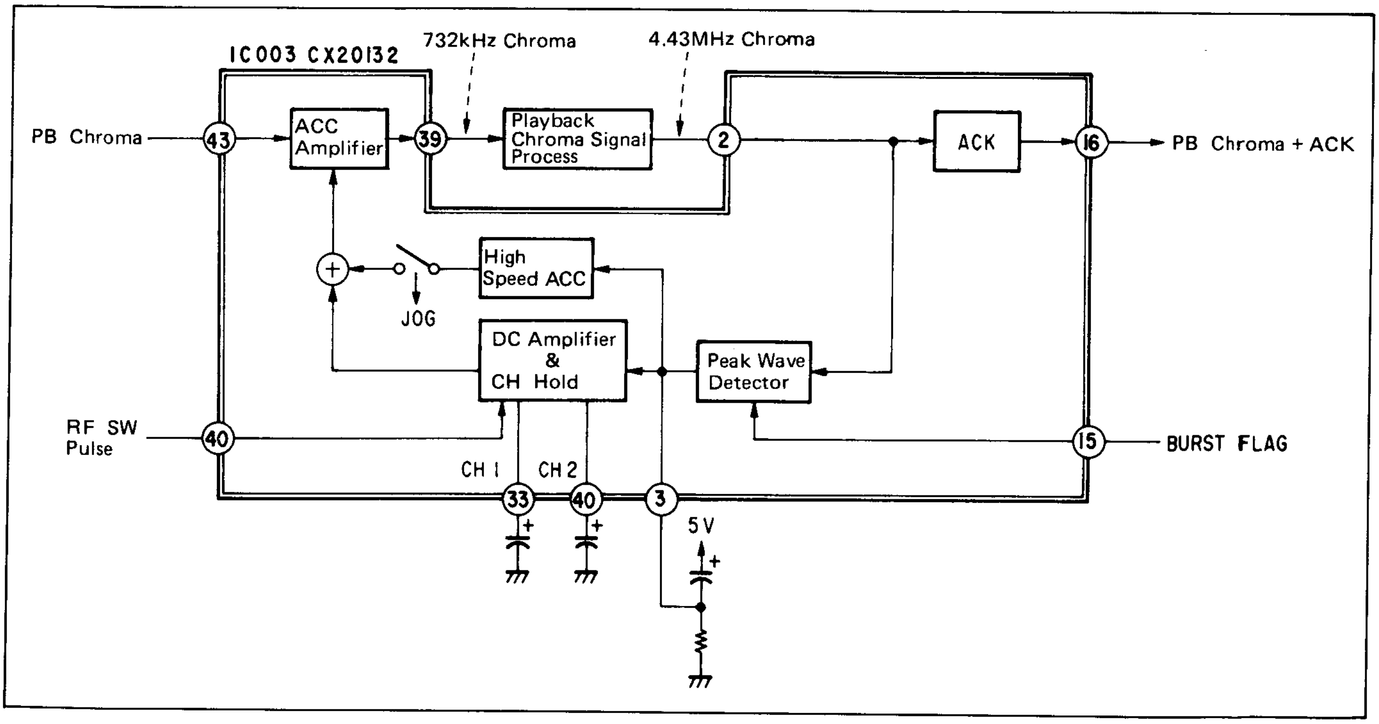


Fig. 2-61. ACC Circuit

The 4.43MHz chroma signal which has been performed playback chroma signal process is fed to the peak detection circuit. This is aimed at preventing maloperation of ACC caused by crosstalk components and noise components. ACC operates so that the burst signal level of chroma signal is maintained at a constant level. Besides, the compensation for the sensitivity difference of video head is made by switching over smoothing capacitor of channel hold circuit by RF SW pulse. Because of the large time constant, integration circuit of ACC is unable to follow up the fluctuation of chroma signal levels of each channel when smoothing capacitor is used commonly at CH-1 and CH-2, and therefore produces flickers. However, if the time constant is diminished, it is advantageous to the floowup and detrimental to noises.

[High Speed ACC Circuit]

Chroma signal level makes large fluctuations in a short period during variable speed playback. (For example, during picture searching, there are three or four large fluctuations in one field.) Consequently, ACC time constant equal to that of ordinary playback mode cannot follow up the level changes. Since ordinary playback time constant is determined by channel hold circuit, the time constant will be diminished by going beyond the circuit. During variable speed playback, response speed is accelarated by amplifing peak hold output by DC amplifier and adding it directly to ACC amplifier gain control signal. Therefore, mean level of chroma signal is controlled by channel hold circuit and high speed change of chroma signal is controlled by high speed ACC.

3. FREQUENCY CONVERSION SYSTEM

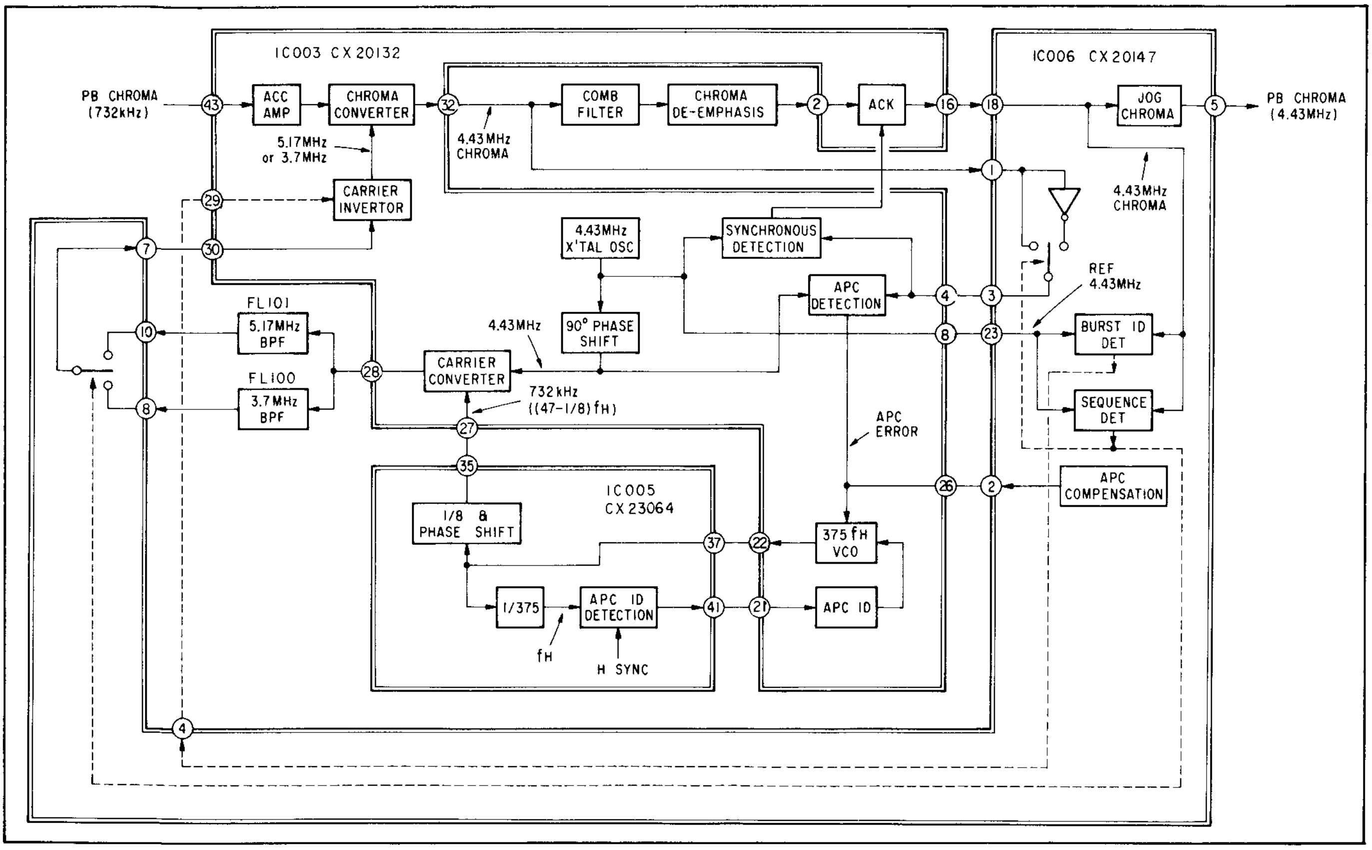


Fig. 2-62. Frequency Conversion Block Diagram

During playback, 4.43MHz X'tal oscillator operates as fixed oscillator i.e., reference oscillator. Jitter element of playback chroma signal is removed by APC circuit. AFC circuit does not operate. APC circuit activates so that burst signal of playback chroma signal being converted at 4.43MHz locks the phase with reference oscillator. APC ID circuit does not operate as far as playback chroma signal is phase-locked by APC, but starts operation only when there is a shift to the extent that the phase adjustment is broken.

3-1. APC CIRCUIT

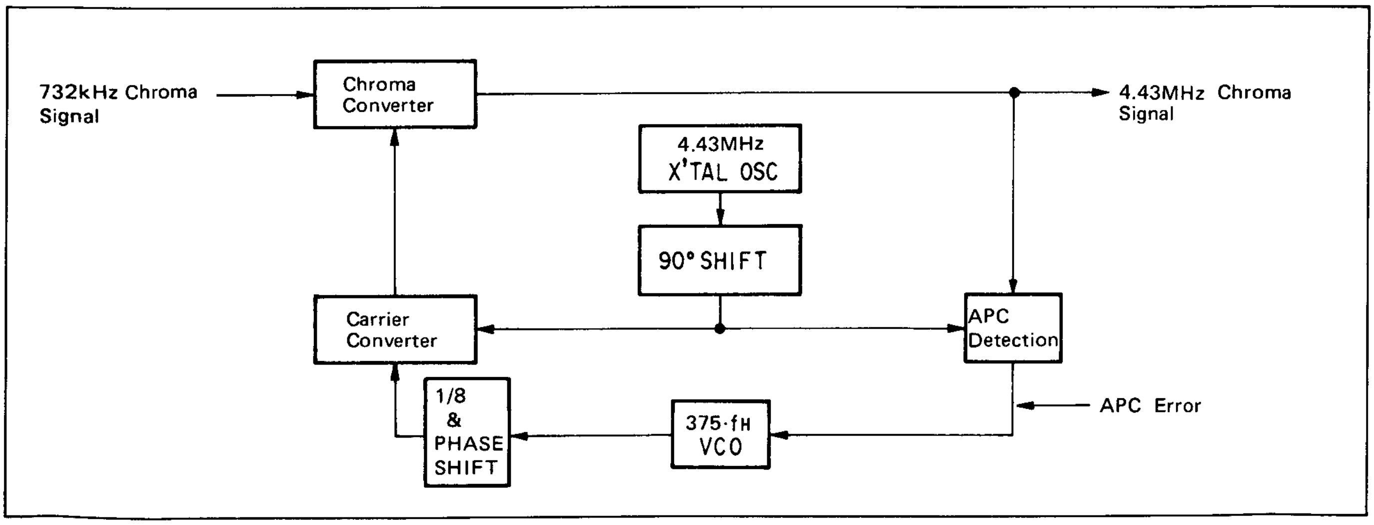


Fig. 2-63. APC Circuit

4.43MHz chroma signal from chroma converter and signal from 4.43MHz reference oscillator flow into APC detection circuit. The phases of the two signals are compared with each other by burst flag during burst period only, and the phase difference is supplied to 375·fH VCO as APC error. After being devided into 8 parts and being performed the phase shift, 375·fH VCO produces frequency conversion carrier with reference oscillator output. This signal converts 732kHz playback chroma signal into 4.43MHz chroma signal and performs the cancel of the recording phase shift. This is APC loop. This APC loop locks the average phase of the burst signal of 4.43MHz chroma signal to reference oscillator output signal and cancels jitters. The reason why APC error flows into 375·fH VCO instead of into reference oscillator is that the frequency variable range of VCO is wider and therefore APC loop gain turns large, and permissible range of jitter becomes wider and the response rate turns faster as well. The signal before passing through the comb-type filter is used to prevent the delay by the comb-type filter as a chroma signal for APC detection.

[APC Correction]

In the PAL system, the phase of the burst signal changes +45 and −45° every H, and the APC error voltage produces a step every H. The impact to the 375·fH VCO can be removed by increasing the LPF time constant. However, during playing back, the APC system has to cancel jitter of the playback chroma signal, so the time constant of it cannot be increased. For this reason, the ±45° phase error component is cancelled by producing a voltage, whose phase is opposite that of the APC error, in IC006 and by applying it to Pin ㉜ of IC003.

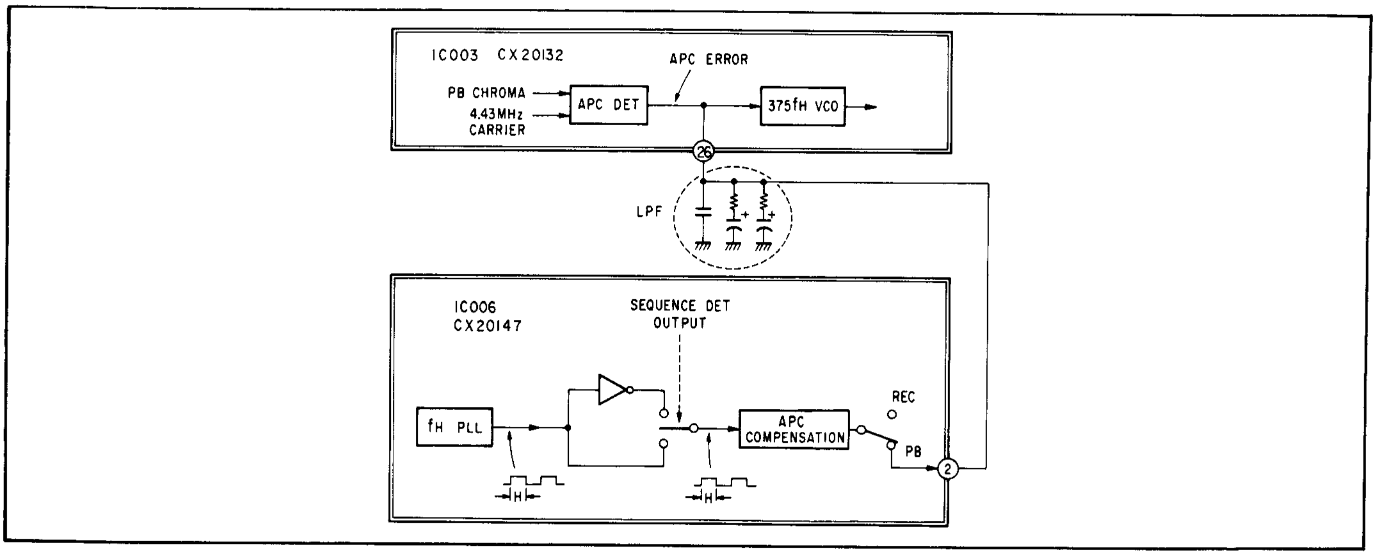


Fig. 2-64.

3-2. APC ID CIRCUIT

APC ID circuit is used on account of the following drawbacks in the single use of APC.

1. A fluctuated picture may appear because it is hard to compensate when a large frequency error occurs during variable speed playback.
2. The following mis-lockings may occur when a wide variable frequency range VCO is used.

(1) The mis-locking occurs at fsc ±n·fH, because APC is controlled by sampling every 1H with burst signal. (fsc: Sub-carrier frequency)

(2) When a crosstalk element is mingled in chroma signal, the phase will be locked and a mis-locking occurs at fsc ±½ (2n + 1) fH.

(3) fsc ±½fH is a quasi-stable point, and therefore mis-locking occurs.

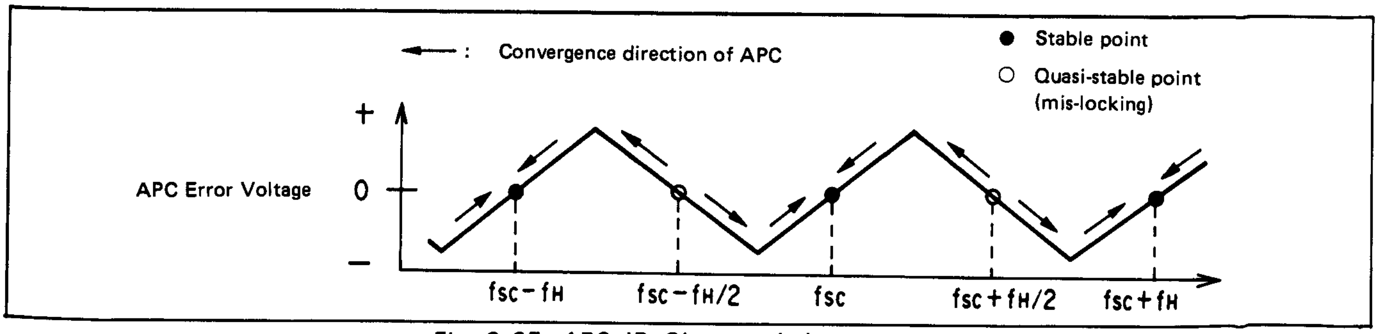


Fig. 2-65. APC ID Characteristics

[APC ID Wave Detection]

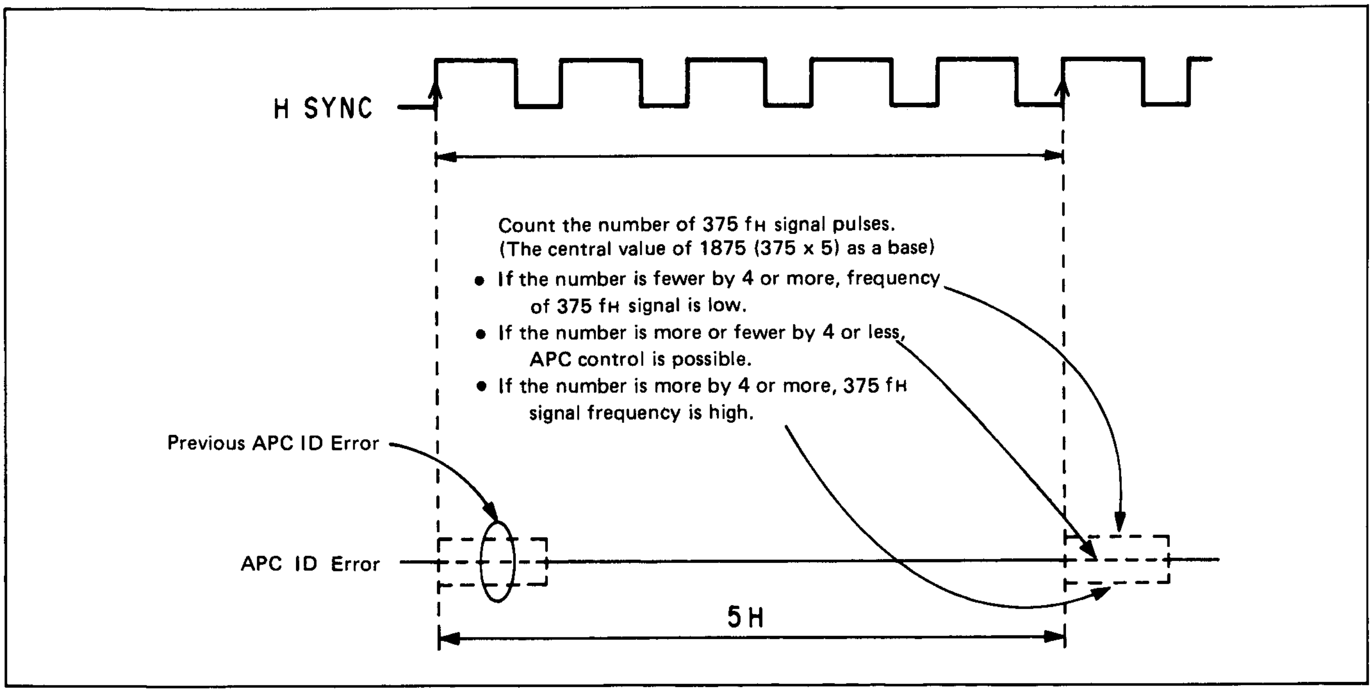


Fig. 2-66. APC ID Timing Chart

APC ID wave detection is done in IC003. 375·fH signal pulse number for 5 periods of H. SYNC is counted here. If the pulse number is more or fewer by 4 clocks (±0.68 μsec) or more against the central value (375 x 5 = 1875), APC ID error signal will beproduced. This is converted to the frequency difference of 4.43MHz signal as listed below.

$$\frac{0.68}{64 \times 5} \times 4.43 \fallingdotseq 9.4\text{kHz} \quad \cdots \text{a little more than } 1/2\, f_H$$

If there occurs difference of more than approximately ±9.4kHz (nearly = more than 1/2fH), APC ID activates and therefore prevents mis-lockings. The control of 375·fH VCO by APC ID error signal is the same as that by AFC ID during playback.

4. CHROMA COMB-TYPE FILTER

Comb-type filter uses 2H delay line, and it is used for the elimination of chroma signal crosstalk element from adjacent track and of noises from line non-correlation.

Playback chroma comb-type filter is a combined one of feed back type comb filter and non-feedback type comb filter as shown in Fig. 2-67.

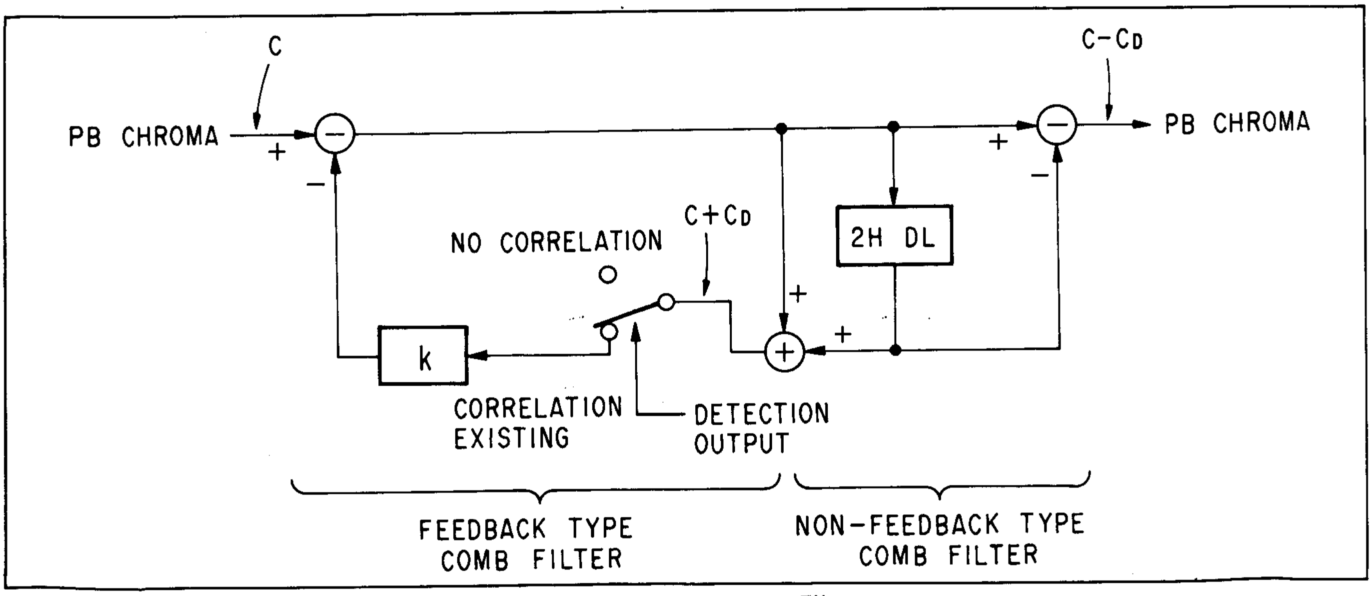


Fig. 2-67. Comb-type Filter

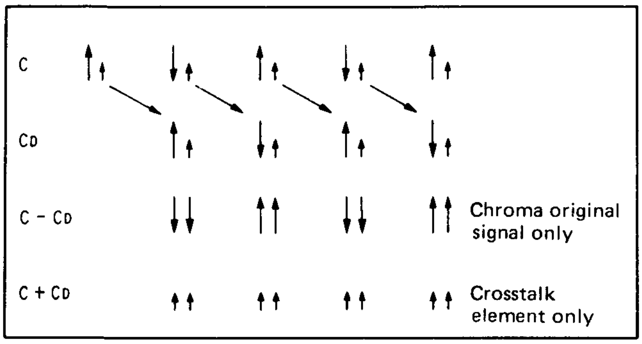


Fig. 2-68. Comb-Type Filter

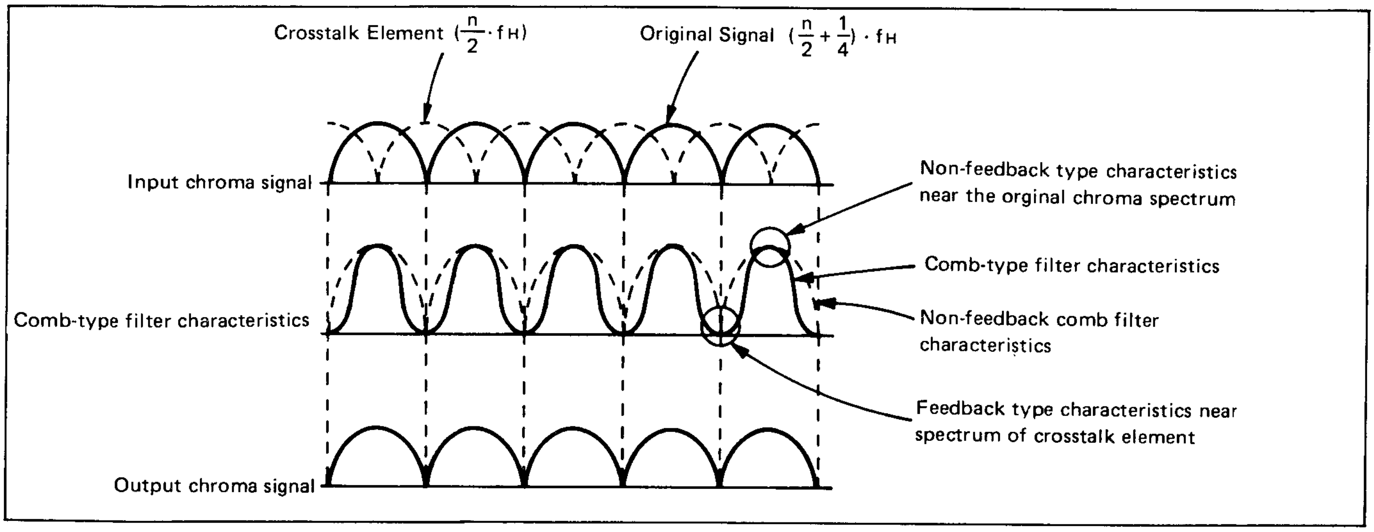
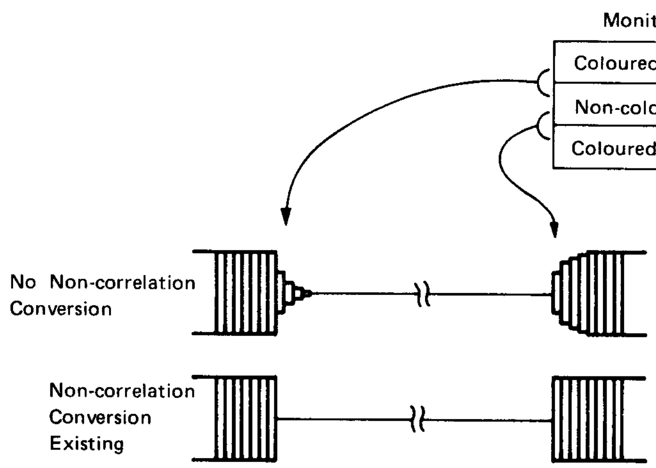


Fig. 2-69. Comb-type Filter Characteristics

Playback chroma comb-type filter with frequency characteristics shown in Fig. 2-69 increases the rate of elimination of crosstalk element in proportion to feedback coefficient k, however, the colour on the monitor image appears shifted downward on accout of the colour conversion delay in the part irrelevant to line correlation when feedback amount is increased. (cf. Fig. 2-70) For this reason, colour shift is kept diminished in the part irrelevant to line correlation by stopping feedback coefficient by correlation signal.



In the case of no non-correlation conversion, chroma signal appears delayed against Y signal and the colour appears shifted downward on TV image due to chroma signal being leveled out between upper and lower lines.

Fig. 2-70. Mis-registration

5. CHROMA DE-EMPHASIS

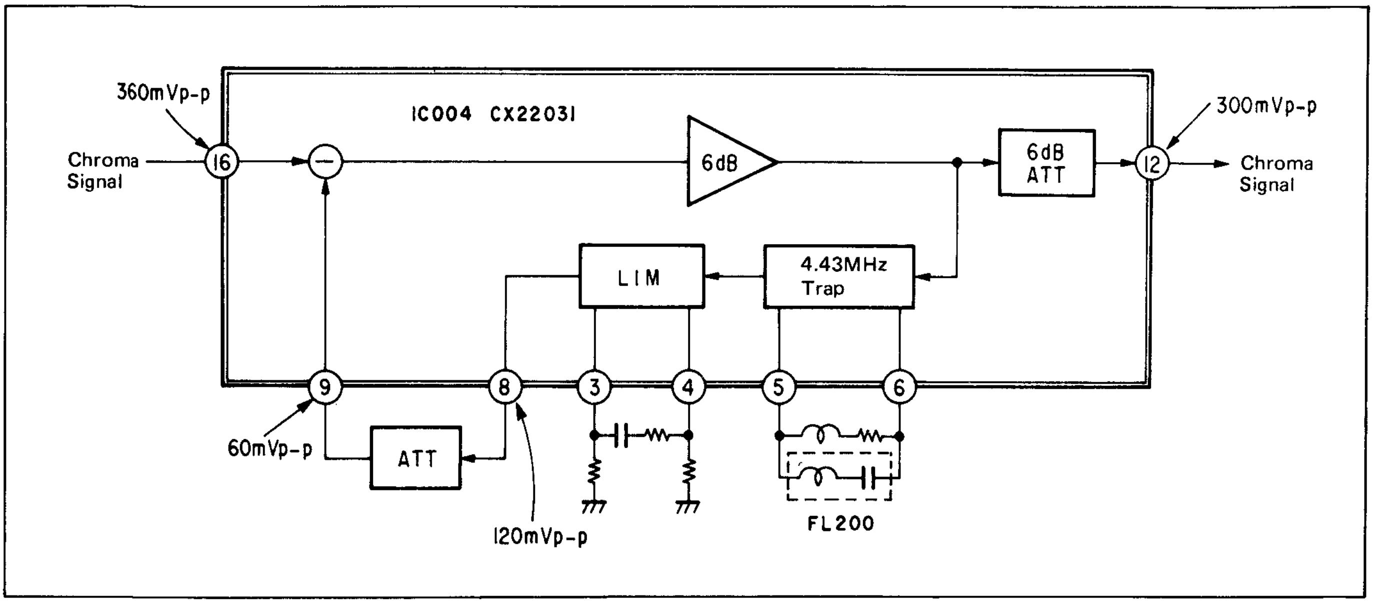


Fig. 2-71. Chroma De-Emphasis Circuit

Reverse characteristics during recording can be obtained by picking out side-band component from chroma signal and negative feeding it back to the input through limiter. The feedback amount is increased and the effect is improved by keeping down the input chroma signal level to a half and maintaing 4.43MHz trap input to the original level by 6dB amplifier. 1/2 ATT in pin ⑫ side corrects the increased amount of 6dB amplifier and keeps the total gain 1 from pin ⑯ to pin ⑫ in chroma signal central band.

6. ACK, BURST ID CIRCUIT

6-1. PHASE DETECTION

4.43MHz chroma signal and 4.43MHz X'tal oscillator output signal which is a reference signal are fed to the phase detection circuit. Two signals are compared the phases only for the burst period by burst flag signal and turn to be phase detection output signal through low-pass filter.

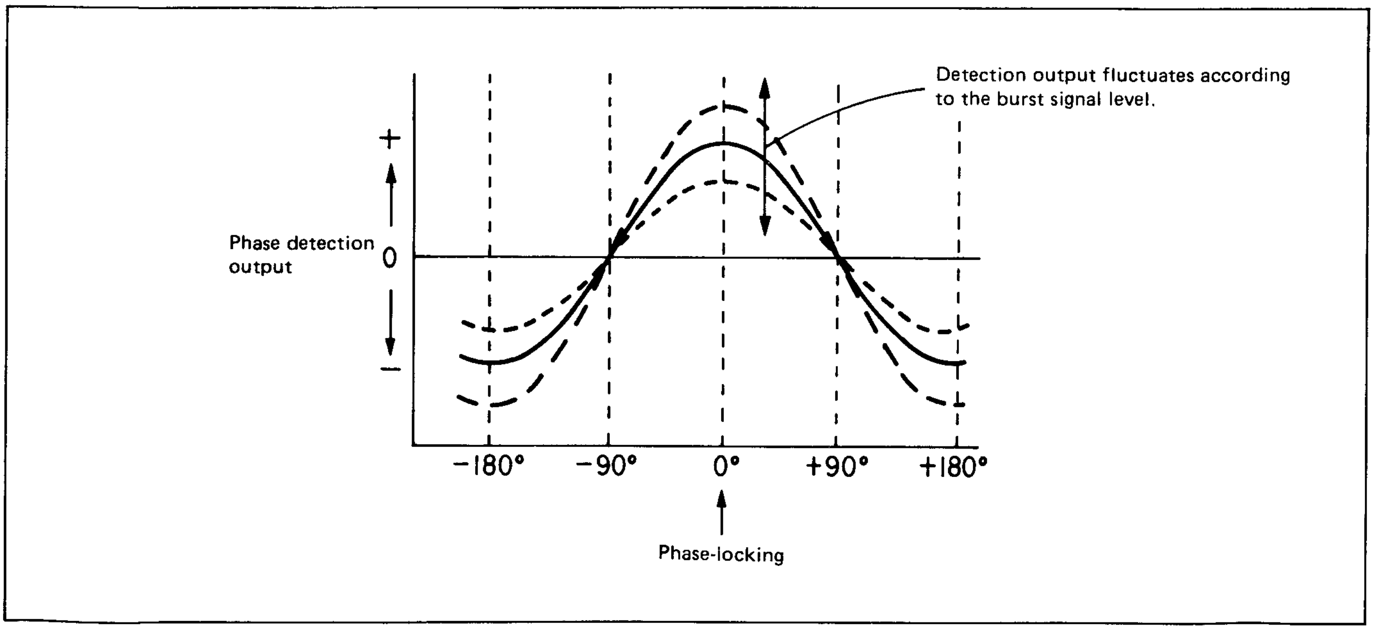


Fig. 2-72. Syncronous Wave Detection Characteristics

6-2. ACK DETECTION

The phase detection output is fed to the comparator and is compared with the base voltage to discriminate either colour mode or black and white mode.

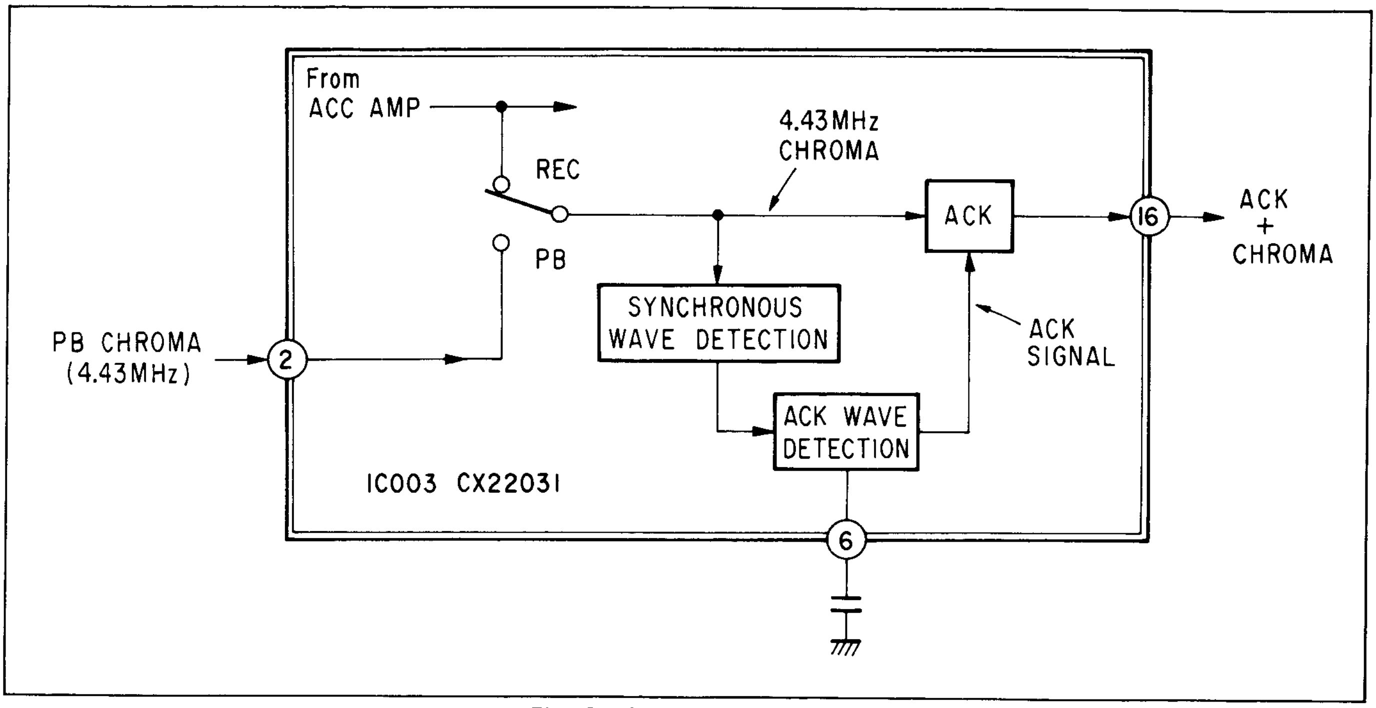


Fig. 2-73. ACK Detection

When APC is phase-locked, phase detection output level is directly proportional to chroma signal (burst signal) level. ACK detection discerns colour mode when phase detection output is more than base voltage, and ACK signal (colour: 2.8Vdc, black and white: 0Vdc) is produced at pin ⑥ of IC003 after being superposed on chroma signal.

6-3. BURST ID

The normal operation area of APC detection is between ±90°. Consequently, APC does not activate normally and requires longer time for a next phase-locking when playback chroma signal has a phase shift of more than ±90°. Burst ID circuit accelarates APC phase-locking by inverting chroma signal when playback chroma signal is out of phase by more than ±90°.

[Burst ID Detection]

In the Beta PAL system, an artificial burst signal (pilot burst signal) equal to the average phase of the burst signal is inserted instead of a burst signal whose phase changes ±45°. Therefore, burst ID can be detected by synchronously detecting this artificial burst signal by an internal reference signal.

In the 8mm PAL system, an artificial burst signal is not inserted, and burst ID has to be detected by a burst signal whose phase varies ±45°.

Burst ID is detected in this equipment by multiplying the playback chroma signal and 4.43MHz reference signal in IC006 and by detecting the multiplication output level of the burst period. In this case, burst ID is decided as abnormal in a positive-or-negative decision of mere multiplication output even if the average burst phase is slided slightly more than 45°. The internal logic circuit decides burst ID to be abnormal only when positive pulses are detected more than twice (2H period) successively.

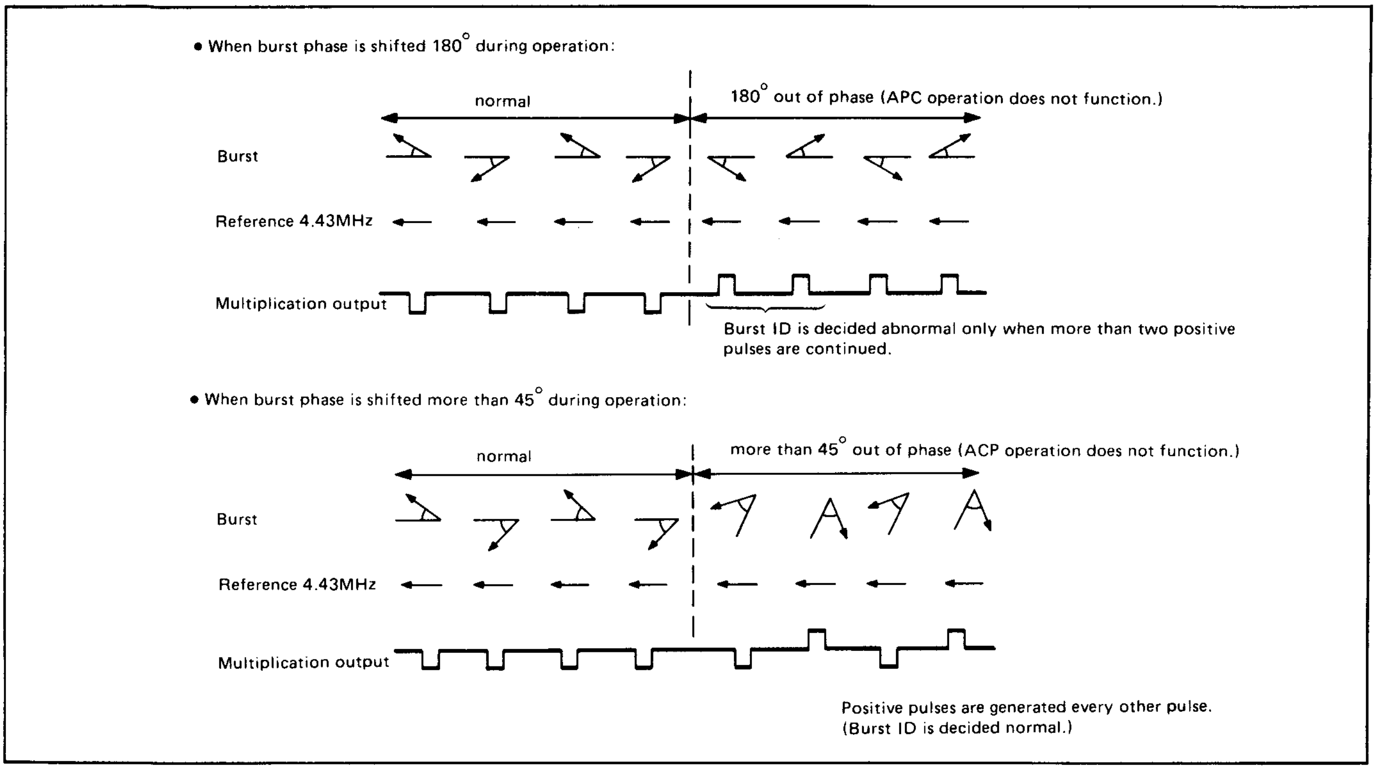


Fig. 2-74.

The phase of frequency conversion carrier is inverted by being applied the burst ID detection logic output from IC006 pin ④ to the carrier inversion amplifier at IC003 pin ㉙, so that the chroma signal is inverted by the burst ID detection.

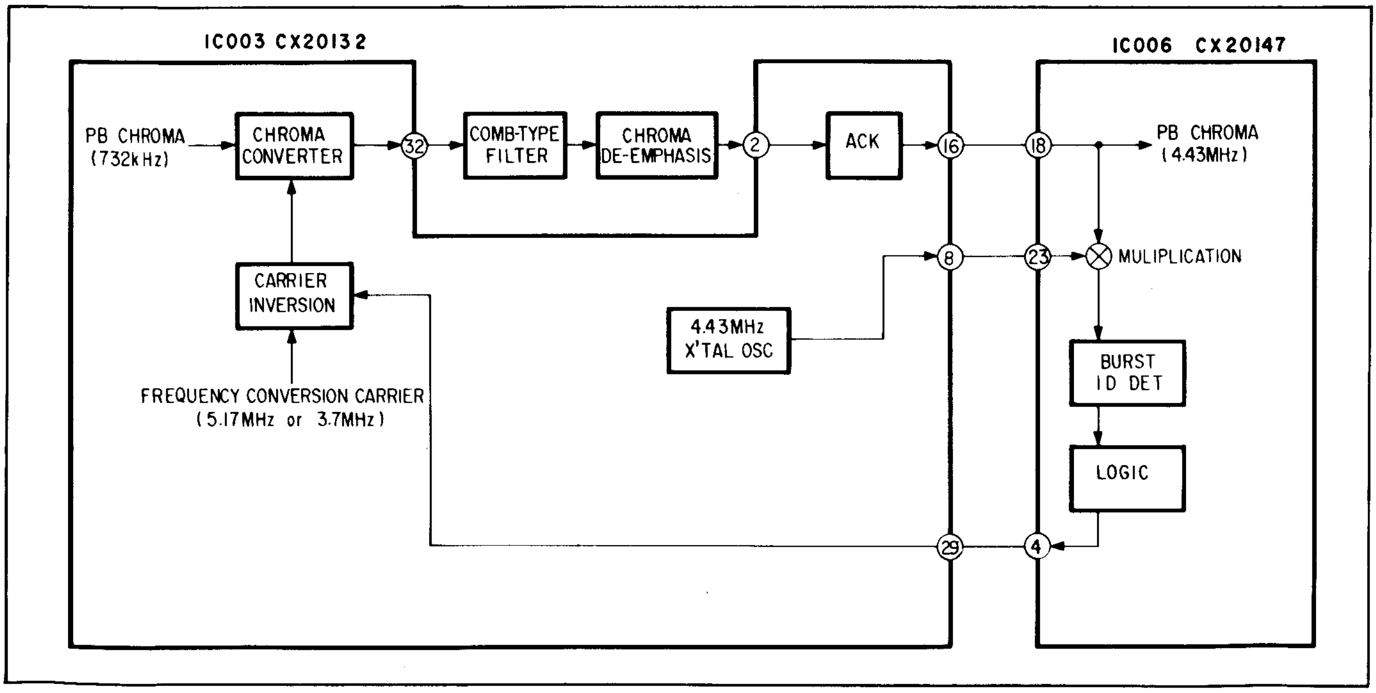


Fig. 2-75.

[JOG Chroma Processing]

In PAL chroma signals, the R-Y signal turns every 1H. In the 8mm PAL system, colour is not aligned on the tape pattern as in the Beta PAL system. Therefore, jumping track is caused during variable speed playback (JOG mode) when the playback head moves to the adjacent track and the (R-Y) and -(R-Y) sequence is lost. Correct colours are no longer played back. To prevent this, the (R-Y) and -(R-Y) sequence is detected by the burst signal, and the chroma signal frequency conversion carrier is changed when the sequence is lost to playback correct colours.

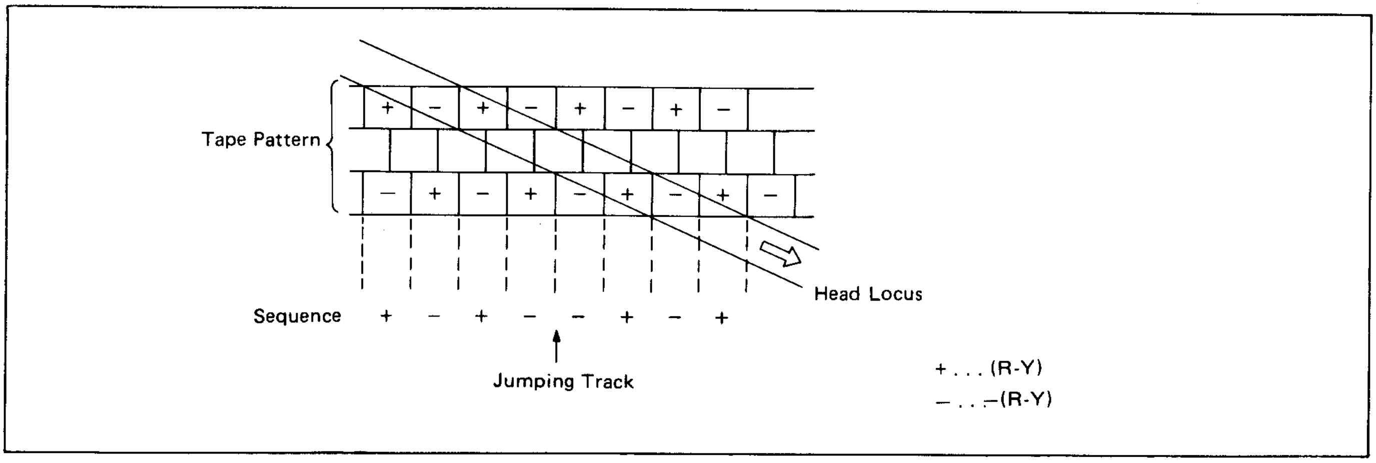


Fig. 2-76.

[Sequence Detection]

The sequence is detected in IC006. An internal reference signal is produced using REF 4.43MHz and fH PLL output signal. This reference signal and playback chroma signal are multiplied only during the burst period, and the sequence detection output is inverted by an internal logic circuit if a positive pulse is generated to the multiplication output. This detection output is applied to the frequency conversion carrier selector, chroma signal inversion, and APC correction circuits.

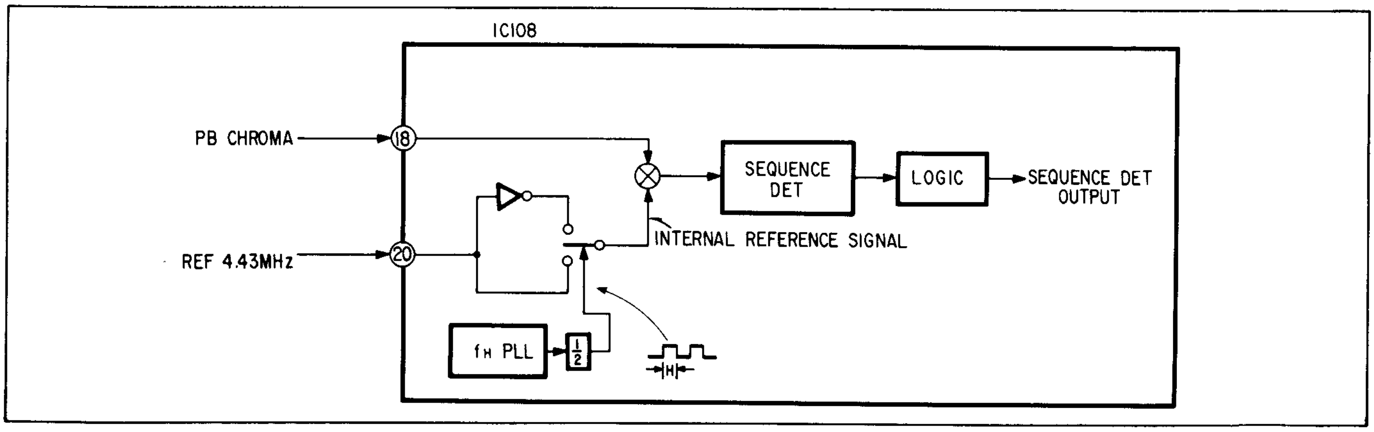


Fig. 2-77.

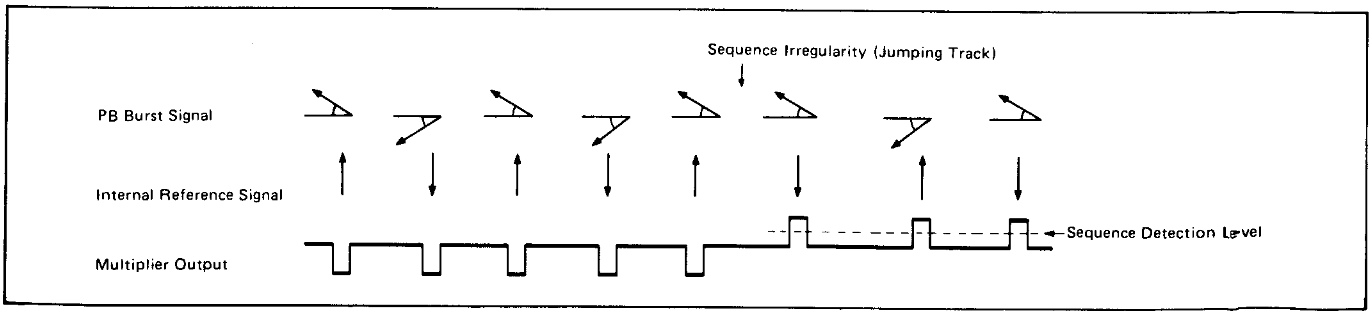


Fig. 2-78.

[Frequency Conversion Carrier Selector Circuit]

In the Beta PAL system, the (R-Y) and –(R-Y) signals is selected by delaying or not delaying the playback chroma signal 1H. This equipment has eliminated a delay line to miniaturize it and to reduce its cost. The (R-Y) signal is turned by changing the frequency conversion carrier. In Fig. 2-79, assuming ω_1 and ω_2 to be 732kHz and 4.43MHz signals of the carrier converter input, which maintain a constant phase relationship with ω_1 by the APC and the playback low frequency conversion chroma signal ω_3 can be expressed as follows:

$$\omega_3 = \omega_1 + \theta$$

θ is phase difference (hue) with the burst average phase.

If ω_3 is composed only of a B-Y signal, θ becomes $0°$or $180°$. If ω_3 is composed only of an R–Y signal, θ becomes $90°$or $-90°$.

By frequency-converting ω_3 by $(\omega_1 + \omega_2)$, that is, by 5.17MHz, the 4.43MHz chroma signal ω_4 becomes as follows:

$$\omega_4=(\omega_2+\omega_1)-\omega_3=(\omega_2+\omega_1)-(\omega_1+\theta)=\omega_2-\theta$$

By frequency-converting by $(\omega_2 - \omega_1)$, that is, by 3.7MHz, the 4.43MHz chroma signal ω_4' becomes as follows:

$$\omega_4'=(\omega_2-\omega_1)+\omega_3=(\omega_2-\omega_1)+(\omega_1+\theta)=\omega_2+\theta$$

When ω_4 and ω_4' are compared, both are symmetric to the (B-Y) axis of $\theta = 0°$, showing that the (R-Y) signal is inverted.

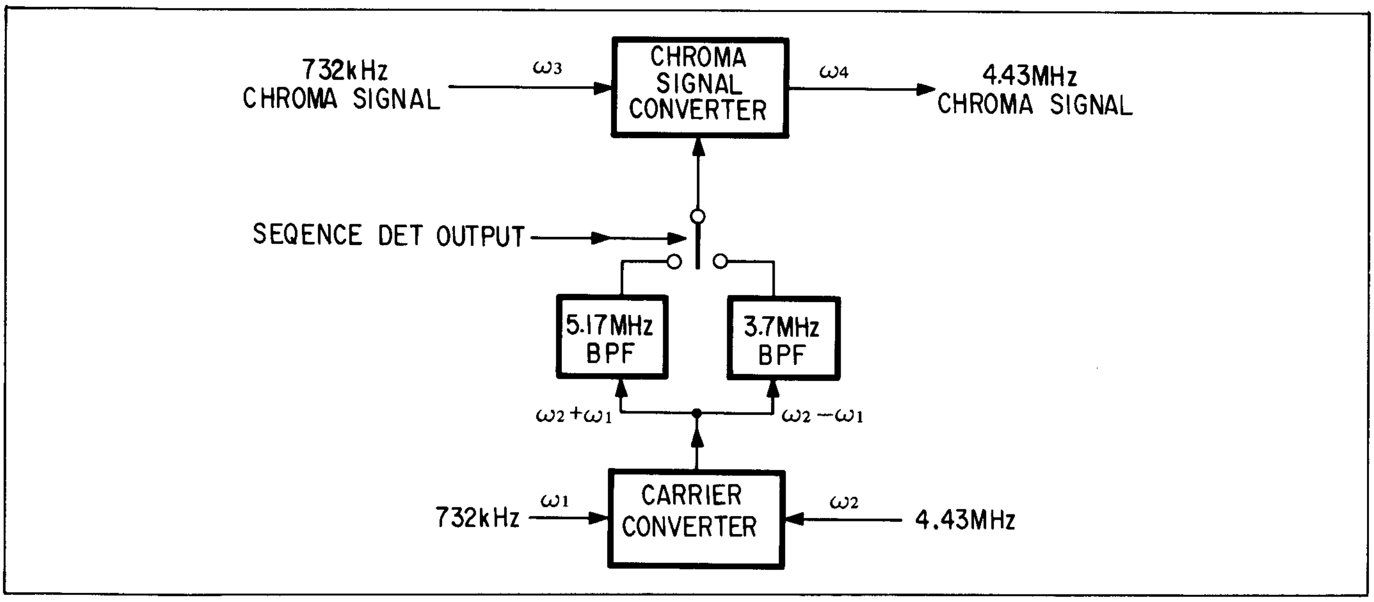


Fig. 2-79.

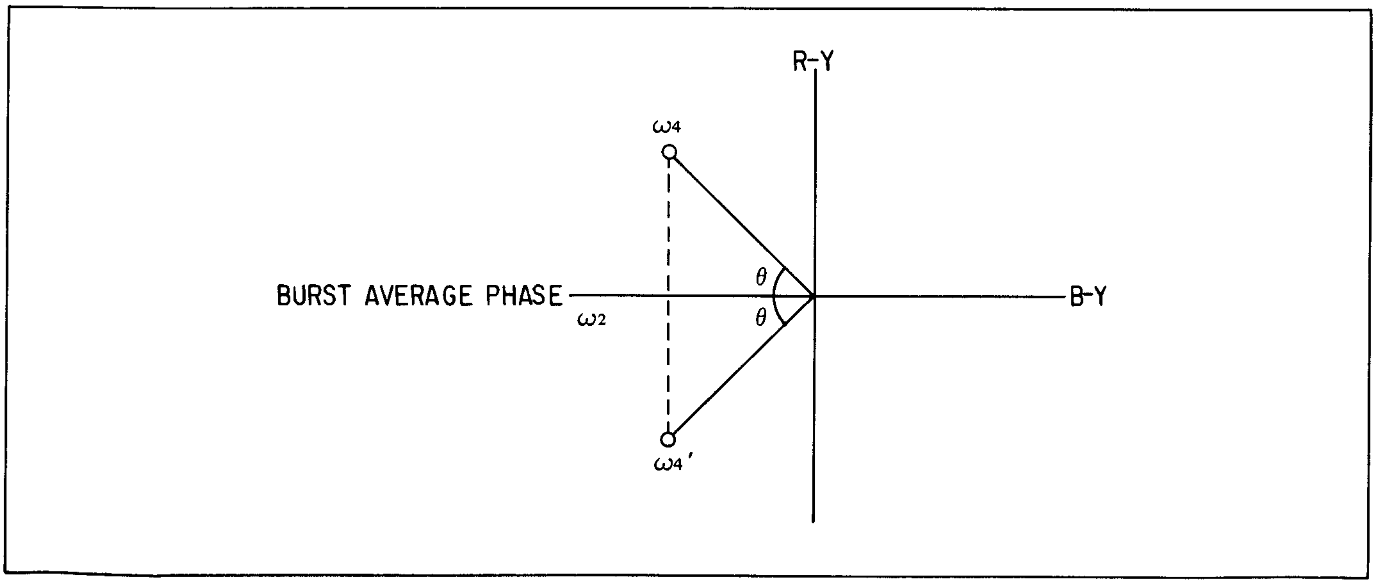


Fig. 2-80.

[Burst Signal Replacement]

As in the Beta PAL system, the PB chroma signal burst is forcibly replaced with the internal burst on the variable speed playback (JOG) mode. By this signal processing, the stable colour pictures are obtained as the colour synchronization and ACC circuits on the TV side are not affected at all by noise of variable speed playback.

The internal burst signal is replaced by the main switch inside IC006. This switch is controlled by the switch control and cleaning flag generation circuits. During variable speed playback (level of JOG signal . . "H"), a change of the burst period to the internal burst signal and of a fixed voltage to the H blanking period other than the burst period is made by burst and cleaning flags. This change to a fixed voltage prevents mixing of noise in the PB video signal horizontal SYNC signal by cleaning the H blanking period of the chroma signal.

The internal burst signal is produced using the REF 4.43 MHz signal and fH PLL circuit output as in the internal reference signal for sequence detection. Therefore, playback noise does not affect.

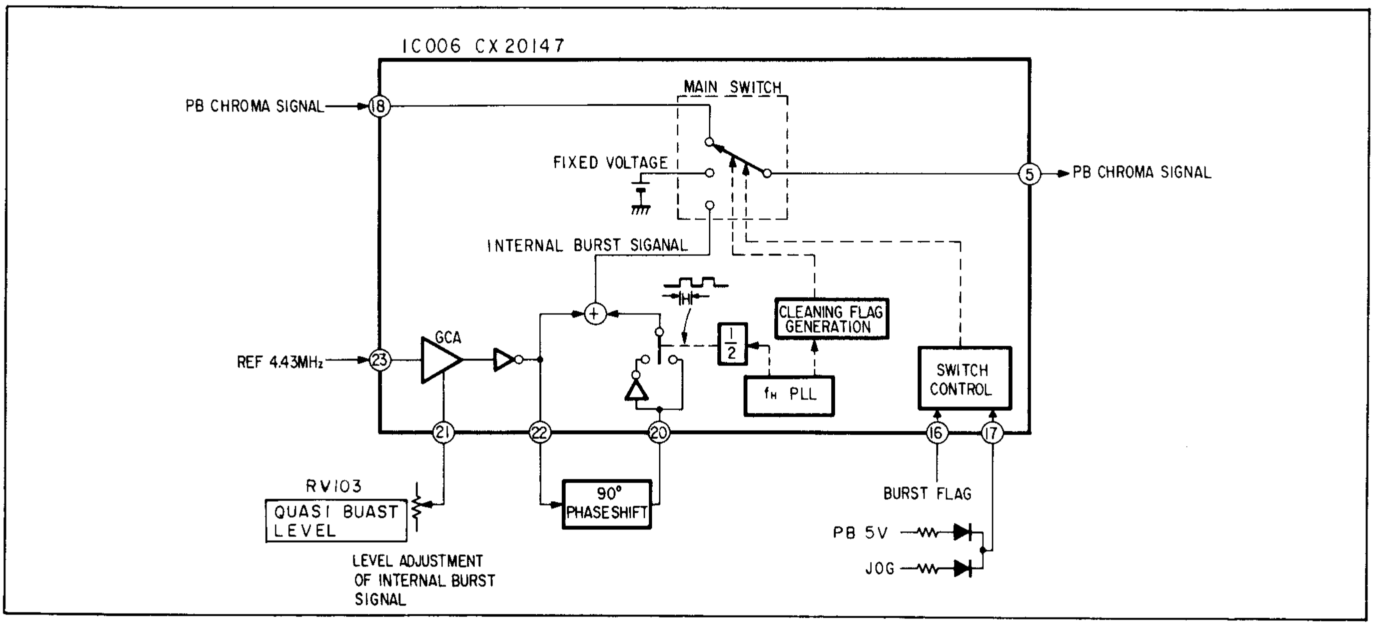


Fig. 2-81.

[Phase Inversion of APC Detection Chroma Signal]

By changing the frequency conversion carrier to correct an incorrect sequence, the APC lock phase is also changed 180°. By this, the APC system becomes instable, and playback colour pictures are disturbed for several 10Hs until the previous steady condition is regained. This is far from practical. Therefore, the phase of the chroma signal input to the APC detection circuit is inverted inside IC006 by the sequence detection output so that the APC system regains a stable condition early. The phase of the APC correction signal is also inverted simultaneously.

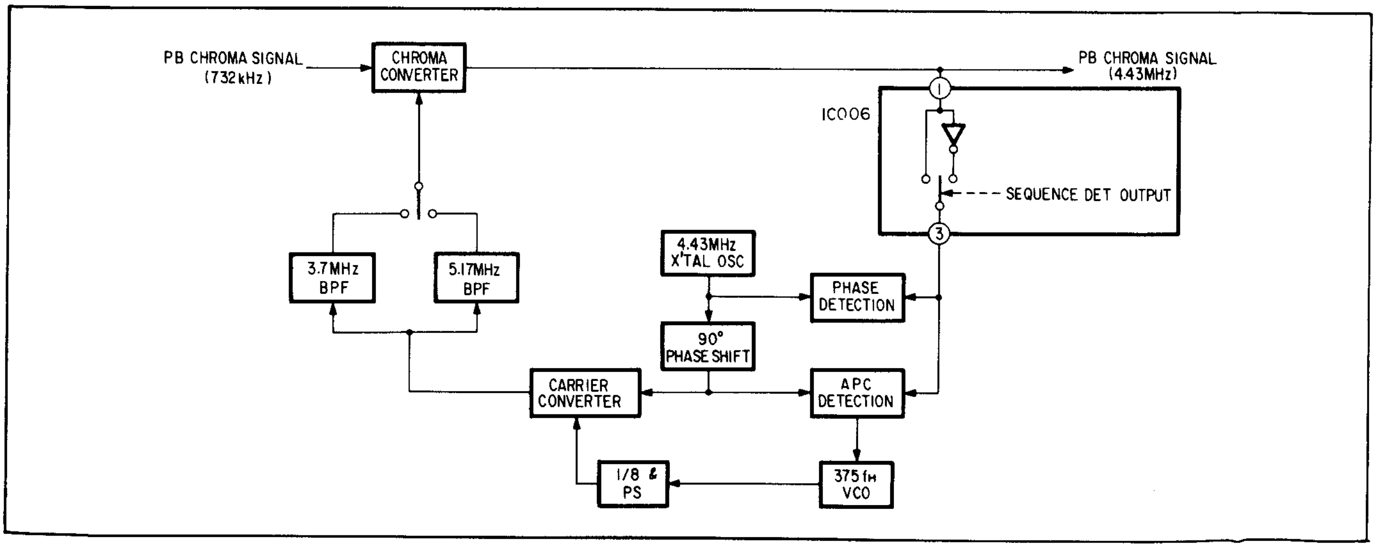


Fig. 2-82.

2-5. GENERATION OF TIMING PULSES

These pulses are all generated in the internal counter of IC005 of CX23064. Also since trigerring is performed at the rise of H sync signal, they fail to be output in the absence of trigger signal.

2-5-1. E-E Trap Signal (Pins ④ and ⑤)

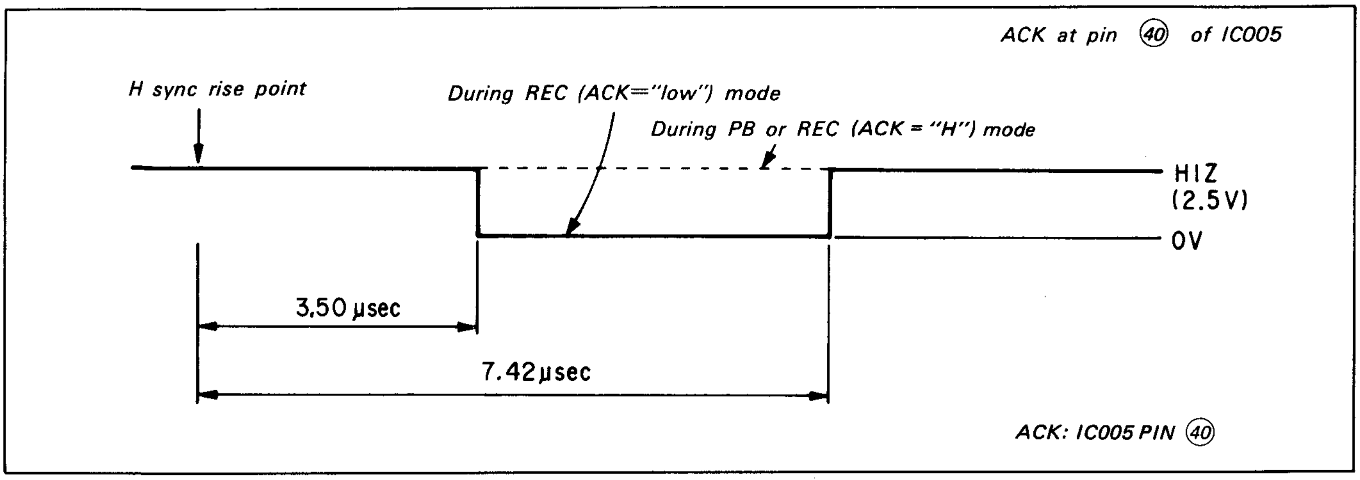


Fig. 2-83. E-E trap signal timing chart

2-5-2. AGC Pulse (Pin ③)

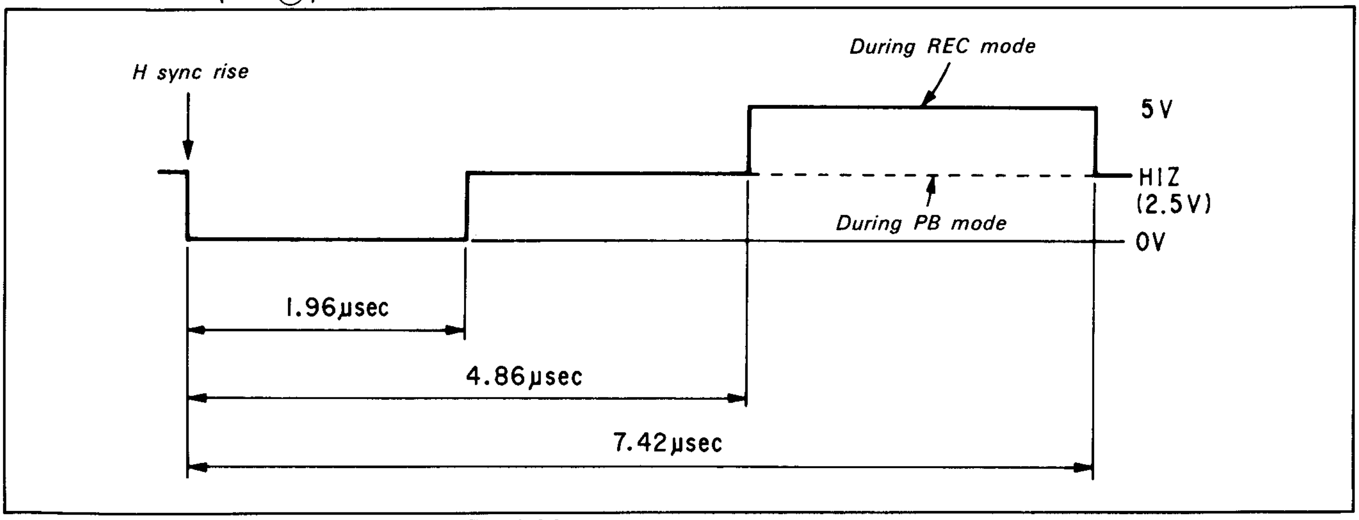


Fig. 2-84. AGC pulse timing chart

2-5-3. Burst Flag Pulse (Pin ①)

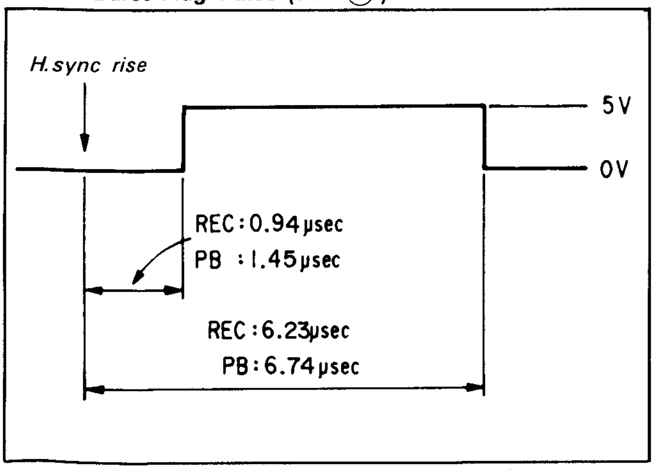


Fig. 2-85. Burst flag timing chart

2-5-4. Burst Extraction Pulse (Pin ②)

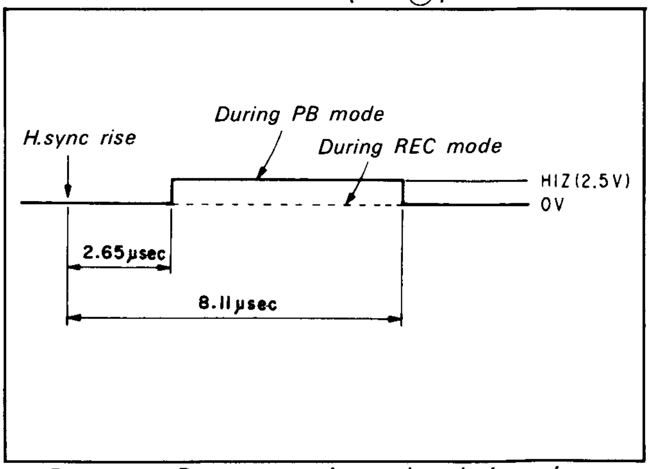


Fig. 2-86. Burst extraction pulse timing chart

2-6. SIGNAL PROCESSING OF AUDIO DUBBING

Part of the played back picture is masked in belt form at the time of audio dubbing.
This is for the reason mentioned below.
At the time of audio dubbing, the PCM audio recording current (in both SP and LP modes) or the flying erase current (in SP mode only) crosstalks on the playback side in the rotary transformer of the drum. As a result, the playback signal is disturbed and making it impossible to obtain a normal playback picture.
In addition, this crosstalk current is not ignorable against the playback signal current level, but is sufficiently small against the recording current level, and therefore the video signal already recorded on the tape is not affected.
As a measure against this disturbance, the Y signal and chroma signal carry out are masking precessing during the recording period of PCM audio signal and flying erase period at the time of audio dubbing in the video circuit.

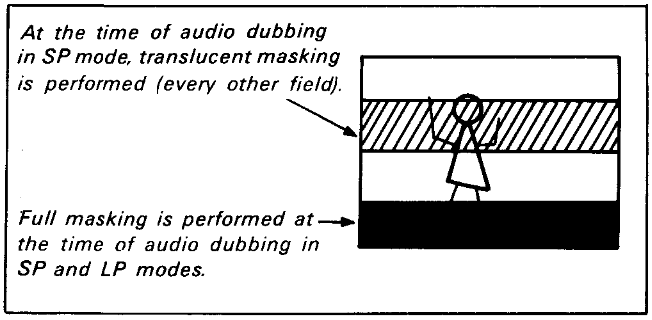


Fig. 2-87.

2-6-1. Control Signal

The control of masking during audio dubbing is carried out by the audio dubbing H SYNC generating IC111 (CX23078) of the PC-15B board.
This IC controls the video circuit with the following 3 signals, and performes masking during audio dubbing.

DUB AREA (pin 15)
The output level is normally "L", but only during the period requiring masking at the time of audio dubbing, that is, when PCM audio signal is recorded or the flying erase operates at the time of audio dubbing, it becomes "H".

HD INSERT (pin 14)
The output level is normally "L", but only during the period requiring masking at the time of audio dubbing, the H sync pulse (false H sync) of "H" level is output. This false H sync is synchronized with H sync (input from video circuit to pin 8 of IC111) immediately before the masking period by the PLL circuit within the IC111. Thus, insertion of false H sync does not disturb the horizontal sync on the TV side.

CHROMA MUTE (pin 11)
The output level is normally "L", but becomes "H" only during the masking period at the time of audio dubbing. This signal differs somewhat from the DUB AREA signal during flying erase operation.

2-6-2. Signal Processing of Y-Signal System

During the masking period of audio dubbing, signals are processed in the following manner in the Y-signal system:
(1) Video signal portion: Replaced with pedestal level
(2) H sync portion: Replaced with false H sync
These signal processing are performed conducted in the H sync insert block within IC002 of VI-9A board. The control signals are comprised of DUB AREA signal and HD INSERT signal. When they are inserted during masking period, Q100 is turned on, and pin 2 of IC002 level becomes "L", and the playback Y signal is cut off so that the output of H sync insert circuit is switched to pedestal voltage. Then, when pin 45 of IC002 becomes "H" with HD insert pulse, the H sync insert circuit output becomes a sync signal tip voltage, and insertion of a false H sync is carried out.
Moreover, since the insertion of false H sync occurs in the early stage of the sync separation circuit (pin 41 of IC001), the COMP SYNC signal is output normally at pin 44 of IC001 even during masking period.

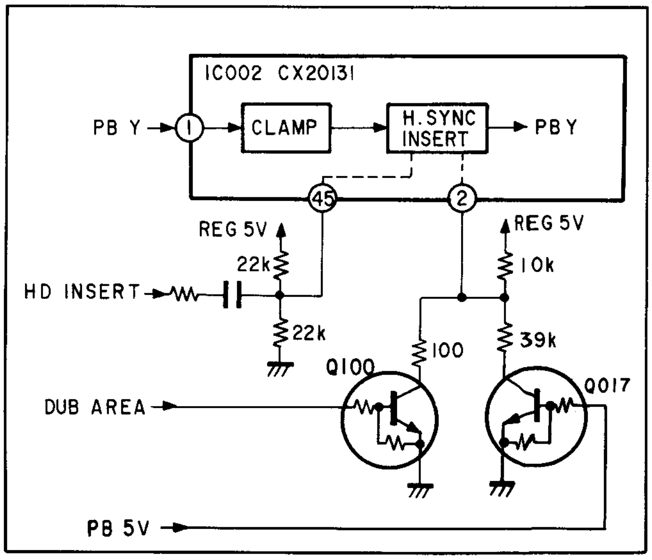


Fig. 2-88.

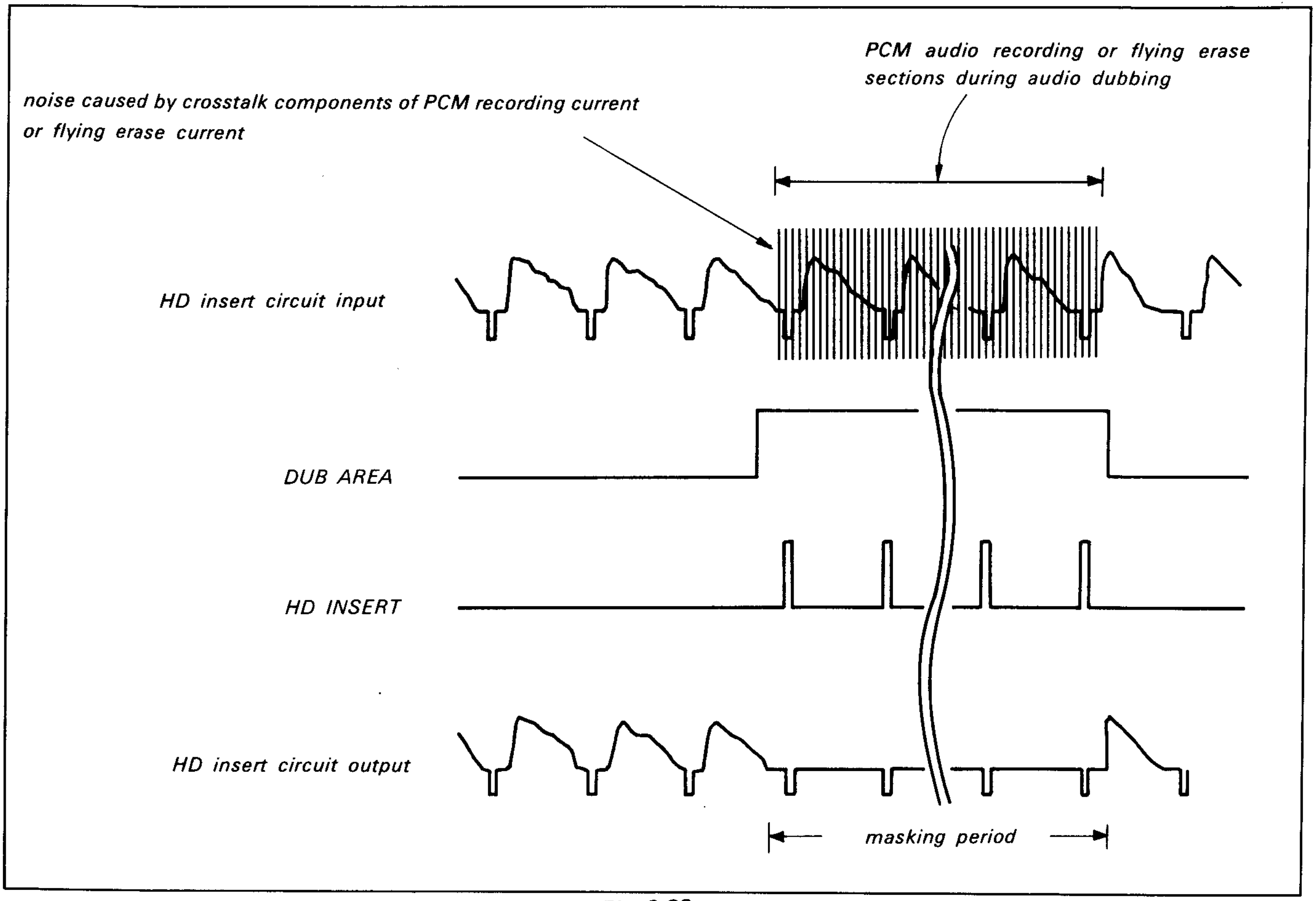


Fig. 2-89.

2-6-3. Signal Processing of Chroma Signal System

During the masking period of audio dubbing, the chroma signal system carries out the following signal processing:
(1) Muting of chroma signal playback output
The operation (1) is for masking of crosstalk noises. The CHROMA MUTE signal is used to turn onQ214 and mutes the chroma signal output from pin ⑯ of IC003.

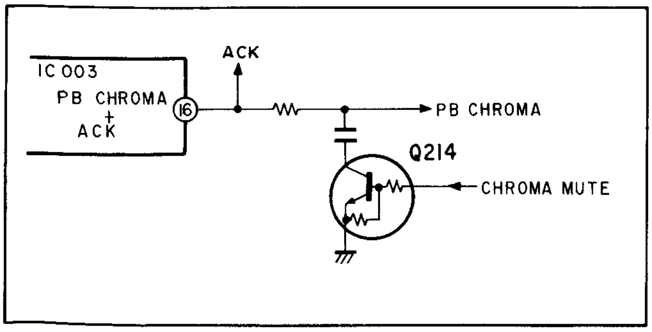


Fig. 2-90.

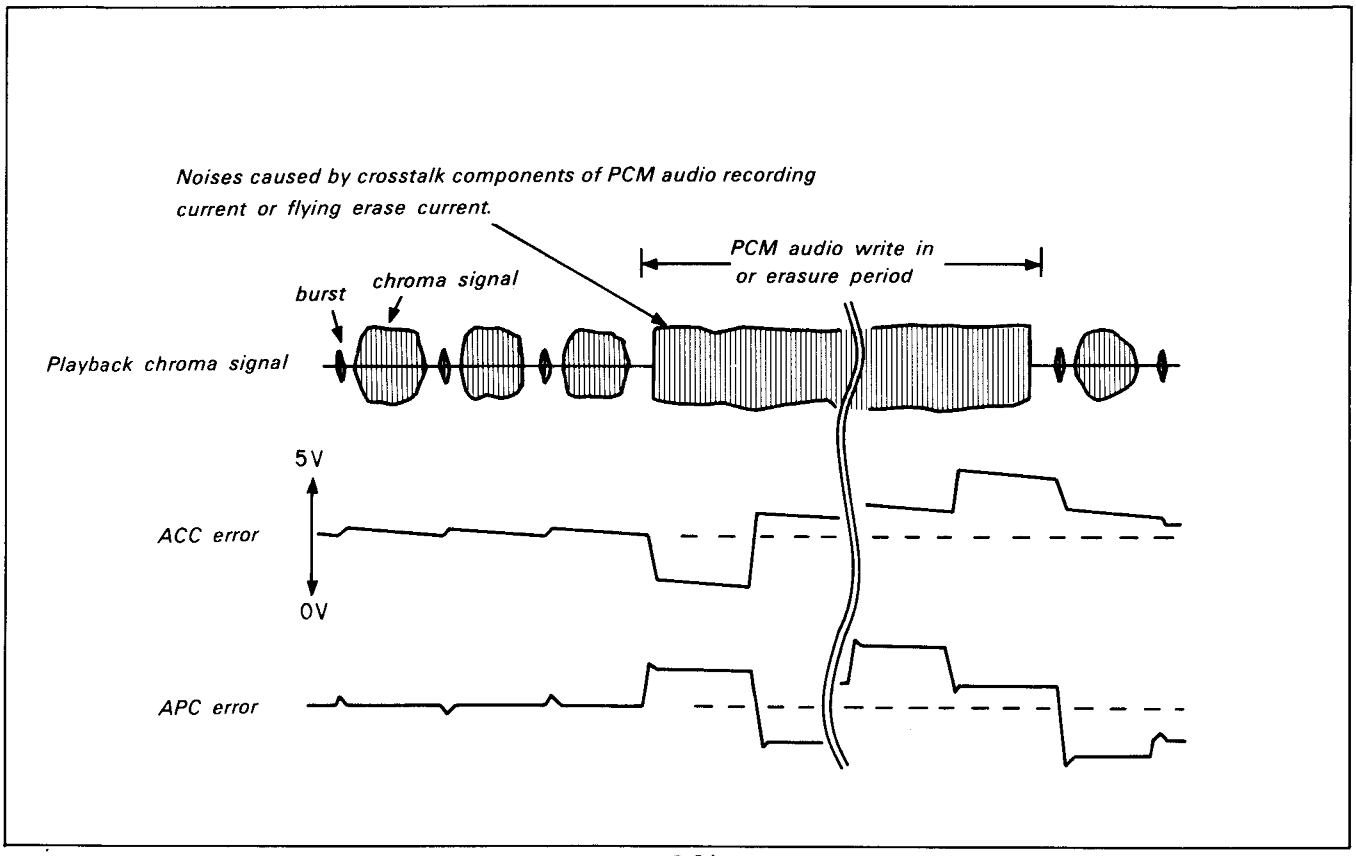


Fig. 2-91.

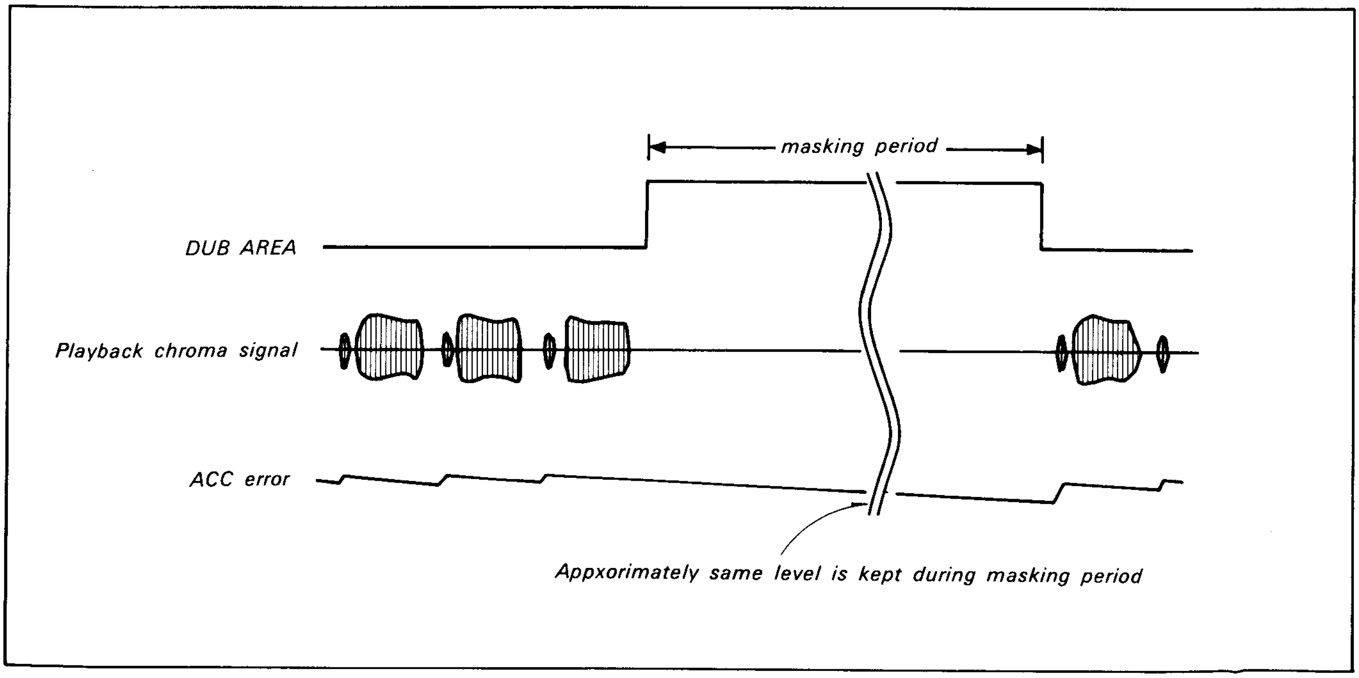


Fig. 2-92.

SECTION 3
SERVO CIRCUIT

3-1. OUTLINE:

Incorporated partly in SS-38F/G, MD-8D and VI-9A boards, the servo circuit consists mainly of drum capstan FG sensor amplifier, drum capstan servo, drun motor driver, capstan motor driver and ATF servo. The SS-38F/G board incorporates a drum capstan FG sensor amplifier and drum capstan motor driver.

The performance of the above parts is as follows:

(1) Drum capstan FG sensor amplifier (MD-8D board):
The amplifier amplifies the micro-output from FG (Frequency generator) and PG (Pulse generator), shapes the wavefrom and outputs them at logical level (0 to 5V) to drum capstan servo.

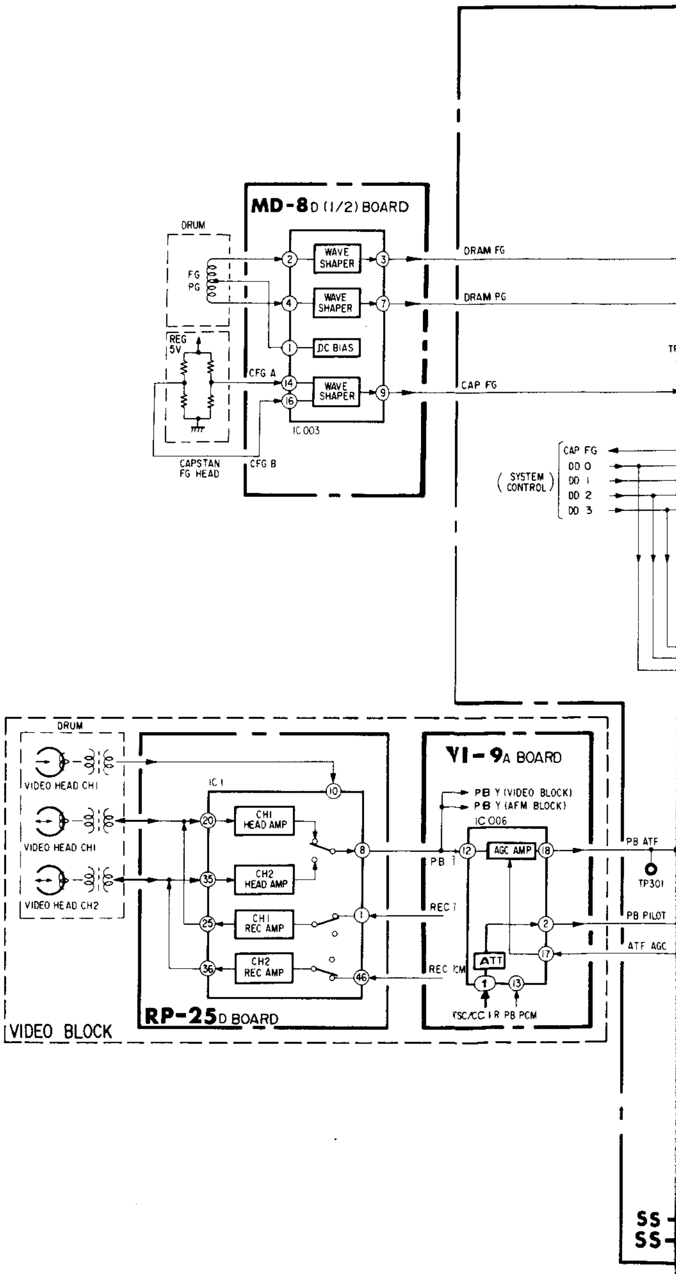
(2) Drum capstan servo (SC-38F/G board):
This part consists of digital servo IC (IC201: CX20135) and cue review speed correction block.
The CX20135 contains a drum capstan speed phase servo circuit, generates the drum speed phase error signal form drum FG PG signals and capstan speed phase error signals (in recording only) from capstan FG. The cue review speed correction block serves as a constantcurrent rsgulated power for correcting the capstan speed operation point of the drum capstan in the course of cue review.

(3) Motor driver (MD-8D board):
The motor driver consists of drum motor driver (IC002: CX20144) error-amplifier circuit and power transistor etc. and performs the switching drive of the sensorless drum motor. The drum motor is a three-phase one-way brushless motor.

(4) Capstan driver (MD-8D board):
The capstan driver consists of the capstan driver (IC001: CX20136) and the power transistor and performs the switching drive of the capstan motor.
The capstan motor is a three-phase bothway brushess motor.

(5) ATF servo (VI-9A board):
The ATF servo consists of LPF which removes the signals except ATF from the played back signals. Circuit-modulated IC (IC066: H8D1754B) which is responsible for waveform shaping of the reference pilot signal and the ATF pilot signal generating IC (IC005: CX23064).

(6) ATF servo (SS-38F/G board):
This servo consists of the ATF servo IC (IC301: CX22032) and the externally attached circuit modulated IC (IC302: H8D1756), and generates the capstan phase error signals by playing back the frequency multi-record ATF pilot signals together with the video signals.



3-2. DRUM CAPSTAN FG SENSOR AMPLIFIER (MD-8D BOARD): REFER TO CIRCUIT DIAGRAM (Fig. 3-3).

3-2-1. Drum FG, PG

The drum FG coil generates an approx. 50 mVp-p sine wave output which is amplified by means of a sensor amplifier (IC003) where its waveform is shaped and converted into 0 to 5V logic level.

The frequency is 600 Hz at the record or normal playback mode.

Drum PG amplifies it by means of two approx. 1 mVp-p pulse signals, by which it is converted into 0 to 5V logic level with its waveform shaped.

Fig. 3-2. indicates the signal waveform.

The drum PG requires only two PG pulses between drum FG leading edge and the following leading edge for ensuring the operation of leading signal from drum FG normalized, which are approximately $t_1 > 10\ \mu S$, $t_2 > 100\ \mu S$ in Fig. 3-2.

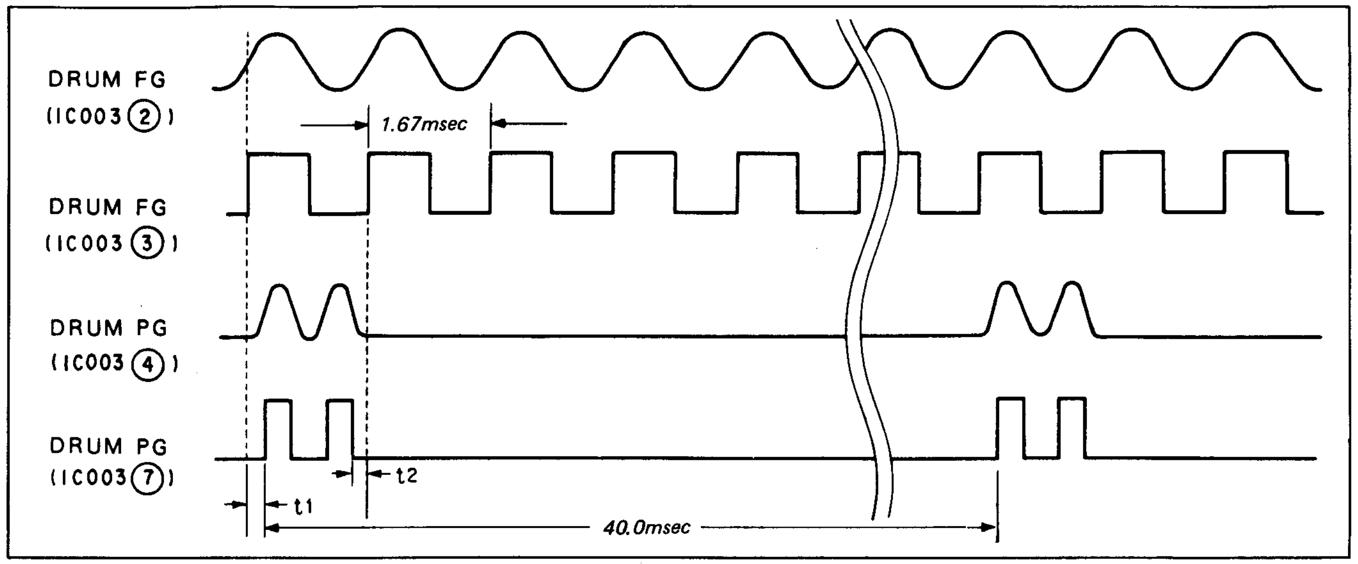


Fig. 3-2.

3-2-2. Capstan FG

Capstan FG employs the flux response type resistor element (MR sensor) which serves amplification and wave shaping. The fequency is 960 Hz (SP recording mode) or 480 Hz (LP recording mode).

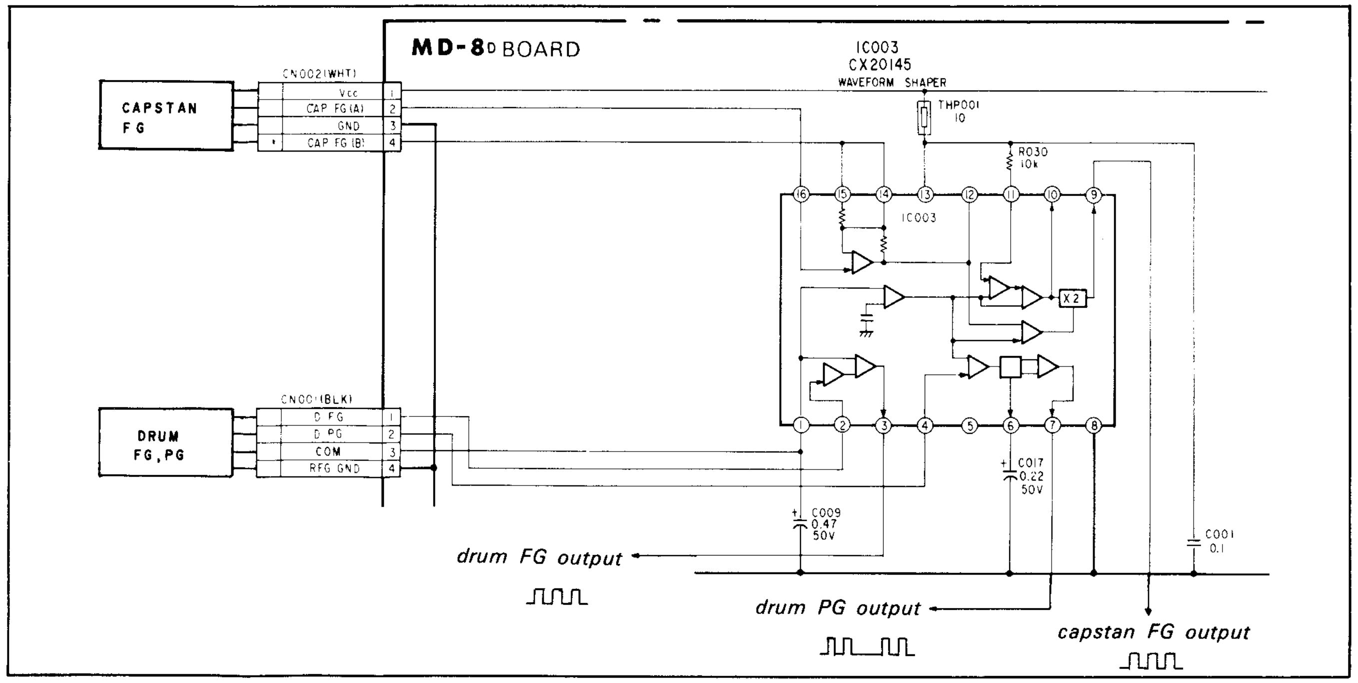


Fig. 3-3. Drum capstan FG sensor circuit diagram.

3-3. DRUM CAPSTAN SERVO (SS-38F/G BOARD)

Refer to Circuit Diagram (Fig. 3-4).

3-3-1. Outline

It is necessary to extraneously input the necessary mode and data setting in the form of serial data to actuate the digital servo IC (IC201: CX20135).

The control system is actuated by means of the control CPU (SS-38D board, IC101) where pins ㉔ to ㉗ of IC201 serve as an interface.

Pins ㉔ to ㉗ act as follows:

㉔ (SI) Serial data input
㉕ ($\overline{CS}$) Active at chip select "L" level.
㉖ (SO) Data output (Servo state flag output)
㉗ ($\overline{SCK}$) Serial clock input (Which controls data input/output timing).

The system control circuit explanation will provide an information of timing relationship between the above pins.

Normal operation of the serial data transfer can be checked by observing the period over which pin ⑱ of SREF signal is generated.

If the SREF period is 20 msec in the record and playback modes, it may be considered that the serial data transfer is in normal operation.

The digital servo IC (IC201) employs chroma sub-carrier (REF 4.43 MHz) as the system clock.

The signal is input as an AC couple into pin ② where it becomes an approx. 300 to 500 mVp-p sine wave. 32-divided output (138kHz) is output to pin ④. Consequently, the system clock normal operation can be checked by observing pin ④.

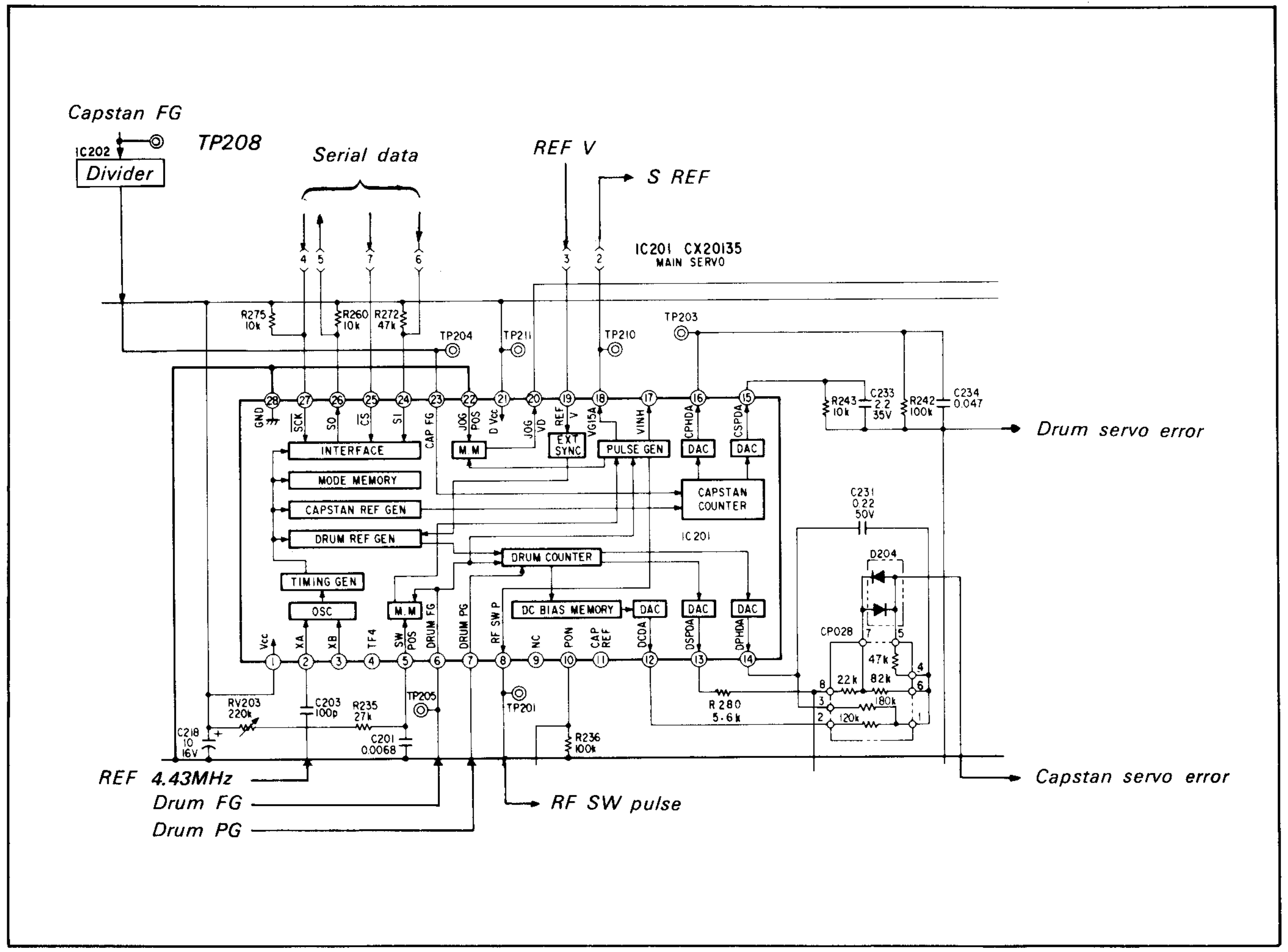


Fig. 3-4.

3-3-2. Dru
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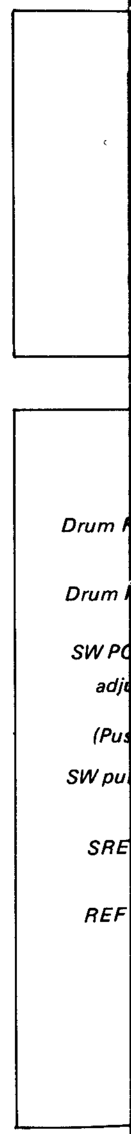

mVp-p pulse
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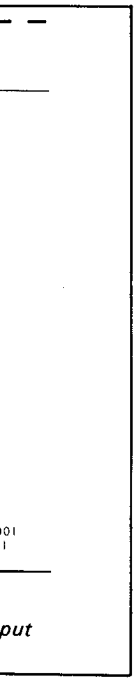


3-3. DRUM CAPSTAN SERVO (SS-38F/G BOARD)

Refer to Circuit Diagram (Fig. 3-4).

3-3-1. Outline

It is necessary to extraneously input the necessary mode and data setting in the form of serial data to actuate the digital servo IC (IC201: CX20135).

The control system is actuated by means of the control CPU (SS-38D board, IC101) where pins ㉔ to ㉗ of IC201 serve as an interface.

Pins ㉔ to ㉗ act as follows:

㉔ (SI) Serial data input
㉕ (CS) Active at chip select "L" level.
㉖ (SO) Data output (Servo state flag output)
㉗ (SCK) Serial clock input (Which controls data input/output timing).

The system control circuit explanation will provide an information of timing relationship between the above pins. Normal operation of the serial data transfer can be checked by observing the period over which pin ⑱ of SREF signal is generated.

If the SREF period is 20 msec in the record and playback modes, it may be considered that the serial data transfer is in normal operation.

The digital servo IC (IC201) employs chroma sub-carrier (REF 4.43 MHz) as the system clock.

The signal is input as an AC couple into pin ② where it becomes an approx. 300 to 500 mVp-p sine wave. 32-divided output (138kHz) is output to pin ④. Consequently, the system clock normal operation can be checked by observing pin ④.

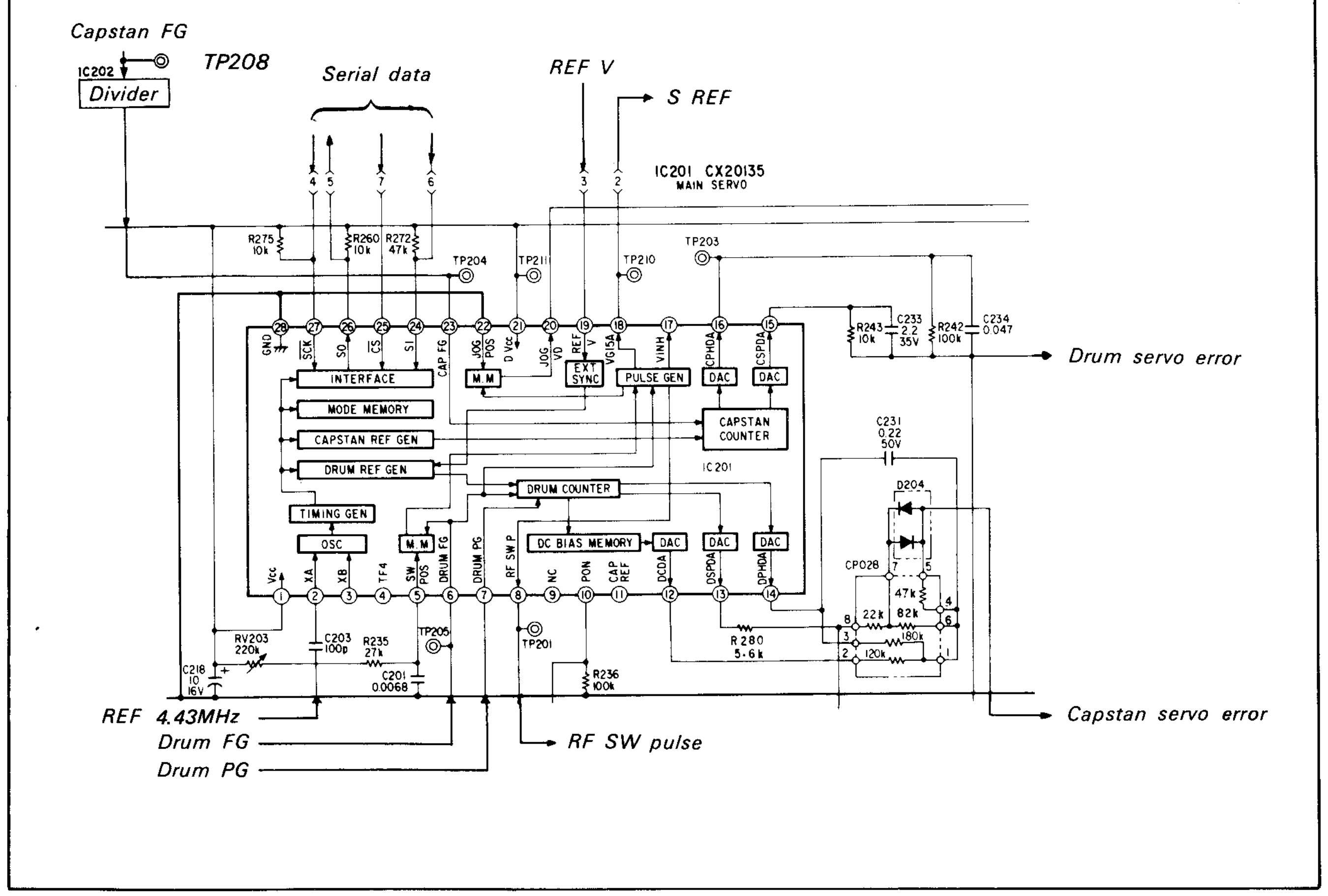


Fig. 3-4.

3-3-2. Drum Servo

The digital servo IC (IC 201 CX20135) incorporates three D/A converters as drum servo error output by which the internal digital data is converted into the analog data having 0 to approx. 4V dynamic range and output.

Drum FG digitally measures the half of the two-divided period within the IC and detects the speed error. Fig. 3-5. shows the hatched area which is used as the gate of the speed measurement. Fig. 3-5 ③. shows the equivalent lamp signals. The speed error is output from pin ⑬ (DSP DA).

The drum phase servo is used for detecting the reference signals and drum PG phase difference. The 50Hz signal which is produced by down-counting the clock signal (REF4.43MHz) within the IC is used as the reference signal. Since during recording mode, the external reference signal (REF V) which is separated from the input video signal and input into pin ⑲ is synchronized with the internal 50Hz counter, drum PG is phase-locked to the external reference signal (REF V). In the mode other than recording, REF V is prohibited, and drum PG is phase-locked to the internal 50 Hz signal. Fig. 3-6. shows the drum phase servo timing chart, where drum PG and RF SW pulse are seen to provide the phase difference determined by the IC. Since on the other hand, the SREF signal is synchronized with the external reference in recording mode, the phase servo will eventually operate so that the phase difference between RF SW pulse and SREF signal are at a constant value. Fig. 3-6. shows the time difference t at approx. 550μS. Consequently, the drum phase servo can be checked for normally by observing the time difference between the RF SW pulse and the SREF signal.

The drum phase servo error is output from DC DA output terminal (pin ⑫) and DPH DA output terminal (pin ⑭). DC DA output serves as a phase lamp to draw into the phase lock while DPH DA output does as the phase lamp after the phase lock. DC DA output is used in such a way as to ensure the drum lock phase automatic adjustment (so that RF SW pulse transformation point in the recording mode may appear 6.5 hours before the vertical synchronizing signal) by providing the phase lamp after the phase lock with DC bias.

In normal operation, both DC DA output and DPH DA output provide an approx. 2V dc output.

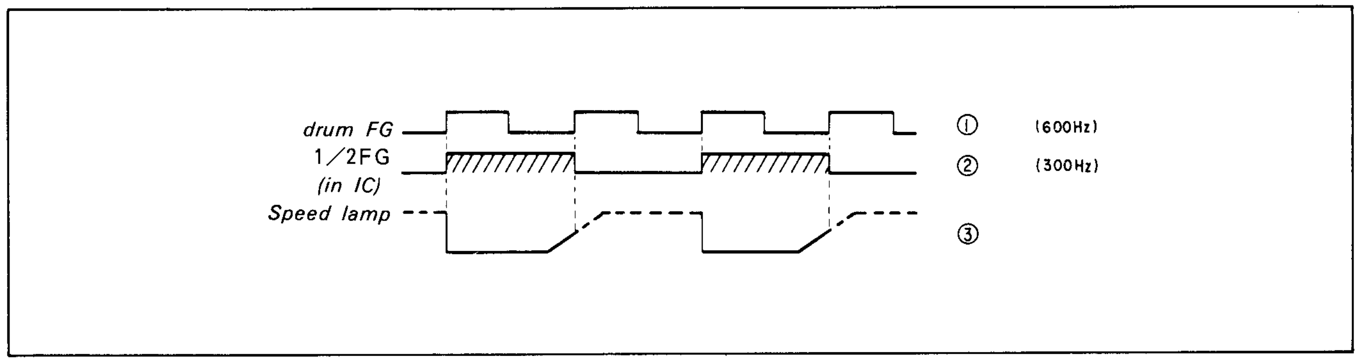


Fig. 3-5.

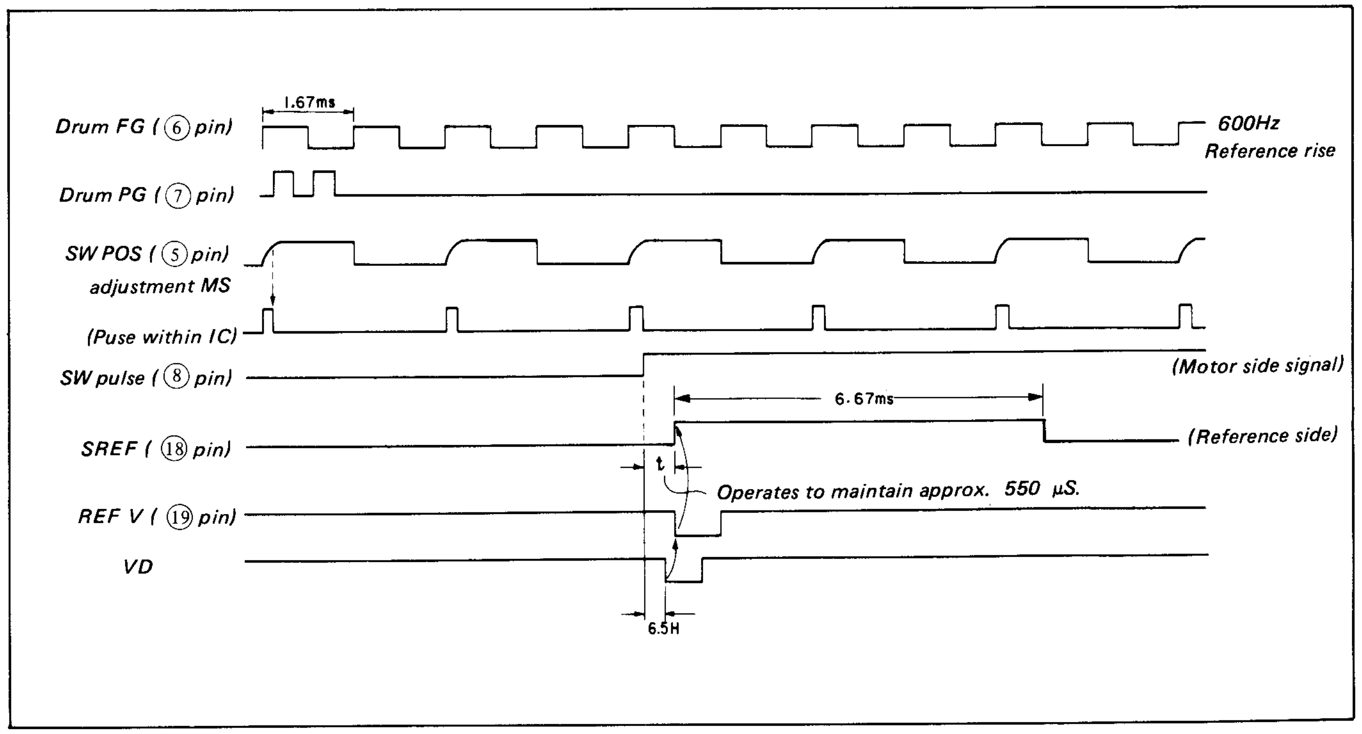


Fig. 3-6. Drum servo timing chart.

SECTION 3
SERVO CIRCUIT

3-1. OUTLINE:

Incorporated partly in SS-38F/G, MD-8D and VI-9A boards, the servo circuit consists mainly of drum capstan FG sensor amplifier, drum capstan servo, drun motor driver, capstan motor driver and ATF servo. The SS-38F/G board incorporates a drum capstan FG sensor amplifier and drum capstan motor driver.

The performance of the above parts is as follows:

(1) Drum capstan FG sensor amplifier (MD-8D board):
The amplifier amplifies the micro-output from FG (Frequency generator) and PG (Pulse generator), shapes the wavefrom and outputs them at logical level (0 to 5V) to drum capstan servo.

(2) Drum capstan servo (SC-38F/G board):
This part consists of digital servo IC (IC201: CX20135) and cue review speed correction block.
The CX20135 contains a drum capstan speed phase servo circuit, generates the drum speed phase error signal form drum FG PG signals and capstan speed phase error signals (in recording only) from capstan FG. The cue review speed correction block serves as a constantcurrent rsgulated power for correcting the capstan speed operation point of the drum capstan in the course of cue review.

(3) Motor driver (MD-8D board):
The motor driver consists of drum motor driver (IC002: CX20144) error-amplifier circuit and power transistor etc. and performs the switching drive of the sensorless drum motor. The drum motor is a three-phase one-way brushless motor.

(4) Capstan driver (MD-8D board):
The capstan driver consists of the capstan driver (IC001: CX20136) and the power transistor and performs the switching drive of the capstan motor.
The capstan motor is a three-phase bothway brushess motor.

(5) ATF servo (VI-9A board):
The ATF servo consists of LPF which removes the signals except ATF from the played back signals. Circuit-modulated IC (IC066: H8D1754B) which is responsible for waveform shaping of the reference pilot signal and the ATF pilot signal generating IC (IC005: CX23064).

(6) ATF servo (SS-38F/G board):
This servo consists of the ATF servo IC (IC301: CX22032) and the externally attached circuit modulated IC (IC302: H8D1756), and generates the capstan phase error signals by playing back the frequency multi-record ATF pilot signals together with the video signals.

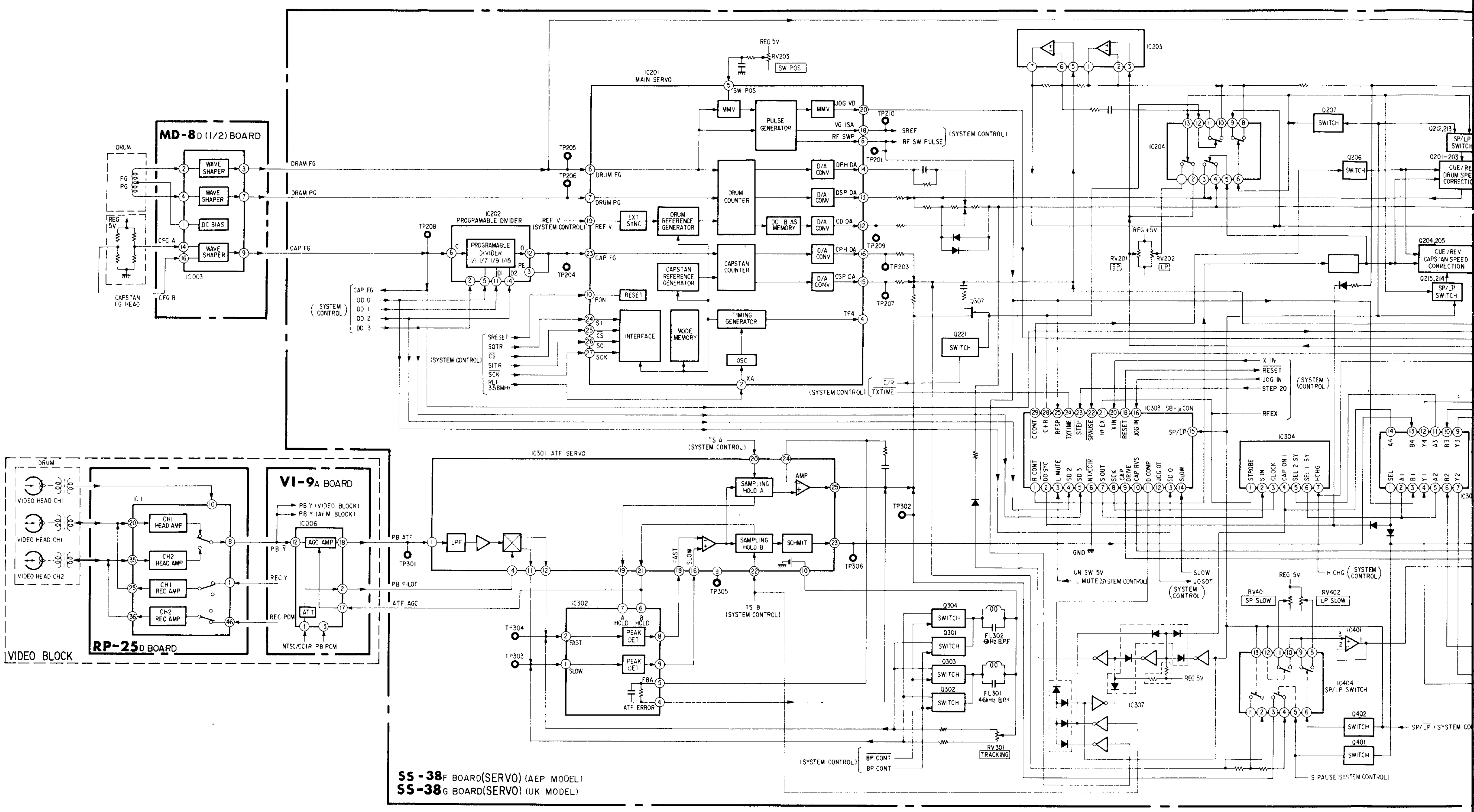
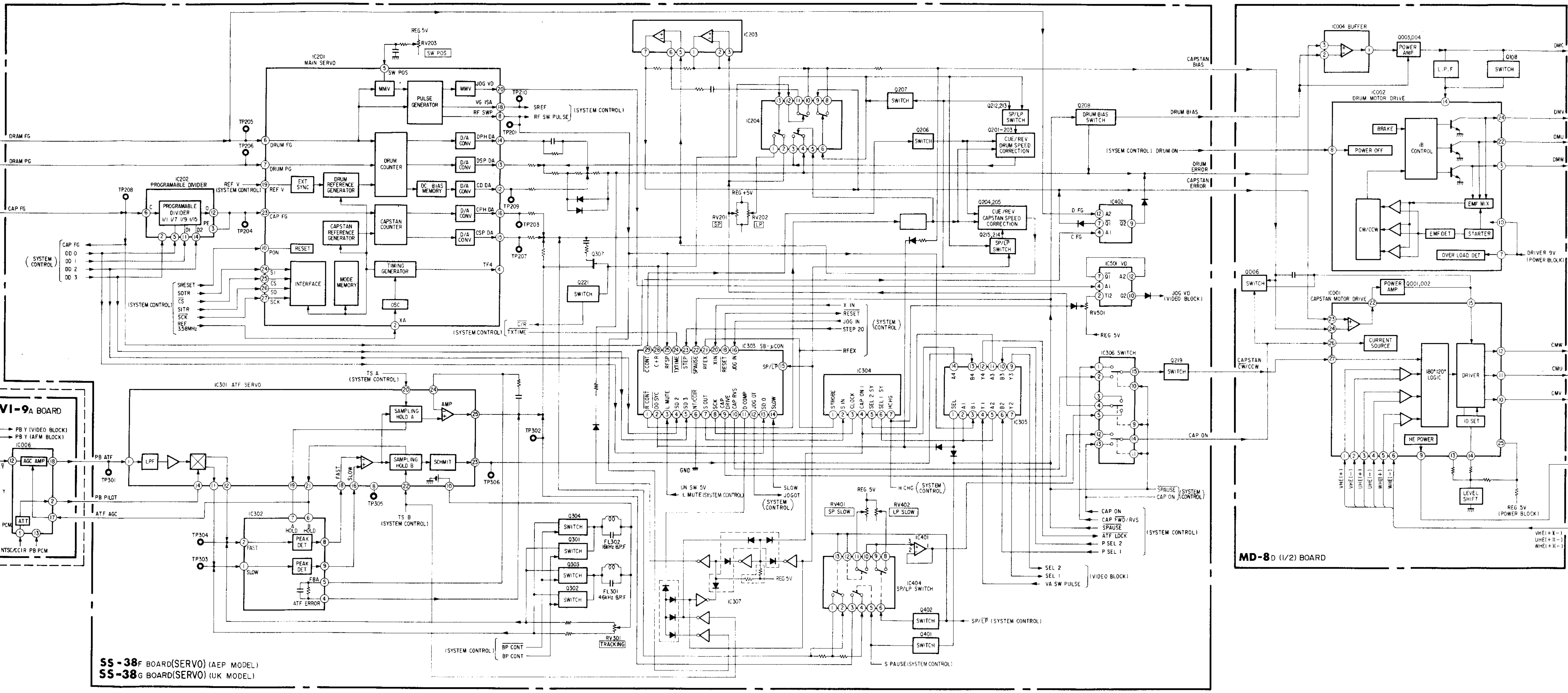


Fig. 3-1.



VI-9A BOARD
IC201 MAIN SERVO
IC202 PROGRAMABLE DIVIDER
IC301 ATF SERVO
IC303 SS-µCON
IC304
IC305
IC306 SWITCH
IC002 DRUM MOTOR DRIVE
IC001 CAPSTAN MOTOR DRIVE
DRUM MOTOR
CAPSTAN MOTOR
HALL DEVICE
SS-38F BOARD(SERVO) (AEP MODEL)
SS-38G BOARD(SERVO) (UK MODEL)
MD-8D (1/2) BOARD

Fig. 3-1.

3-3-3. Capstan Servo

Since 8 mm video uses ATF (Automatic Track Finding) system in the playback mode, the servo recording/playback performance is as follows:

Recording: Speed servo + Phase servo
Playback: Speed servo + ATF servo

These error signals are mixed by means of three resistances, i.e. R243, R242 and R246. In the recording mode, the AFT error is fixed to approx. 2.5V dc. In the playback mode, the phase servo error (CPH DA: Pin ⑯ of IC201.) is fixed to approx. 2V dc. Avoid switching from phase servo error (CPH DA) to ATF error or vice versa by means of a switch in recording/playback mode. Capstan FG(IC201) provides a 1340Hz (SP mode) or 670Hz (LP mode) frequency.

The sampling frequency of the speed error and the phase error is the same as that of the capstan FG. Consequently, in the recording mode, it is observed that the wavefrom is sample-held at the above-cited frequency in both CSP DA output (pin ⑮) and CPH DA output (Pin ⑯). The operation is perfomred in both outputs chiefly at abt. 2V.

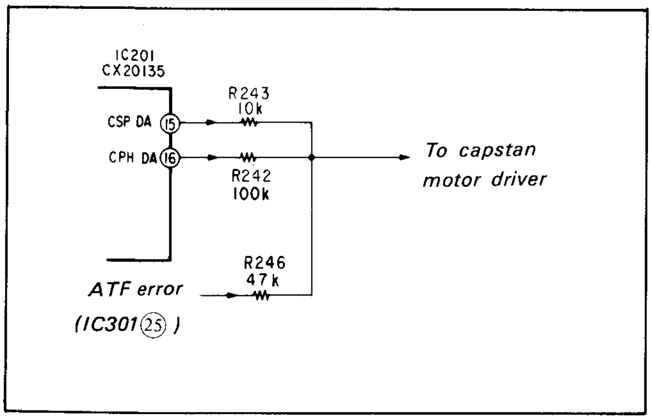


Fig. 3-7.

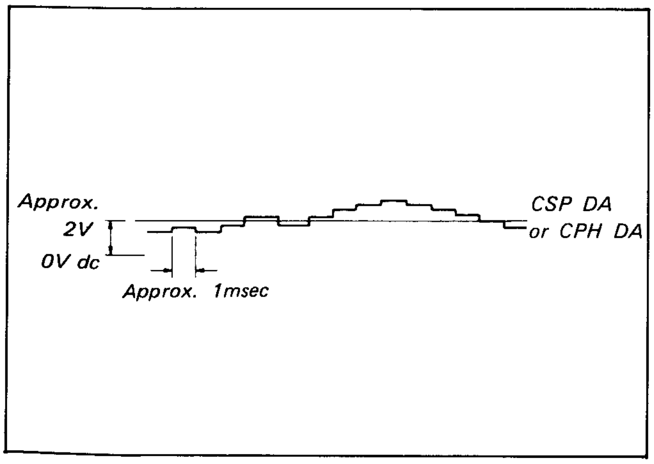


Fig. 3-8.

3-3-4. Correction of Drum fH and Capstan Velocity in Cue Review

Since the tape speed is increased during the cue mode 9 times, and during the review mode −7 times (7 times in the inverse direction) as fast as in the case of normal playback, to keep the TV horizontal synchronization from disturbance, it is necessary to adjust the drum RPM respectively. The RPM should be adjusted by controlling the drum speed approx. 5% (SP mode) or approx. 2.5% (LP mode) in the cue mode and approx. −5% (SP mode) or approx. −2.5% (LP mode) in the review mode, of the normal level.

This equipment is so designed as to ensure the control-free operation of the drum during the cue review performance by changing the frequency of the reference signal generated in the digital servo IC (SREF signal) approx. 5% (SP mode) or approx. 2.5% (LP mode) of the normal level so that the drum is phased-locked to it. Since, however, as the system synchronization period conrol alone is not sufficient to correct the drum speed error, the correction is carried out by supplying or drawing in a certain constant current to the connection between R280 and pin ⑧ of CP28.

Fig. 3-9. shows that in the review mode $\overline{\text{R CONT}}$ signal turns to "L" and Q211 and Q201 are ON, where R203 Q201 and R202 are energized and the current is passed by means of a current mirror circuit from the drum system to Q202 and CP032 (I1) and from the capstan system to Q204 and R208 (I3). Although the current causes voltage drop in R280 and R243, Fig. 3-10, through which it is passed mainly, since the voltage is maintained almost unchanged in Point Ⓐ and Point Ⓑ compared with the case of the normal playback, the voltage increases eventually in pin ⑬ of IC201 (drum speed error) and pin ⑮ (capstan speed error), and allowing the drum and capstan to rotate at the speed lower than in the case of normal playback. In the cue mode $\overline{\text{C CONT}}$ and $\overline{\text{R CONT}}$ signals turn to "L". $\overline{\text{C CONT}}$ signal turns Q206 on, causes R207 and Q203 to flow in current I2 and R211 and Q205, current I4. So the current (I1−I2) corrects the drum speed and (I3−I4) corrects the capstan speed. Q212 to Q215 are turned on in the SP mode, with correcting current value changed between SP mode and LP mode.

Although the capstan speed is subject to the above-mentioned speed control, since the capstan FG is nine-divided in the cue mode and seven-divided in the review mode, in practice, the correction is respectively conducted with respect to the speed nine and seven times as fast as the speed in the playback process. The capstan speed can be determined by measuring the frequence of SS-38F/G board TP208 in the capstan FG signal. The following table indicates the frequency in each of the modes:

	CAPSTAN FG Signal	
	SP Mode	LP Mode
Recording or normal reproduction	1340Hz	670Hz
Cue	Approx.12680Hz	Approx. 6180Hz
Review	Approx.8900Hz	Approx. 4572Hz

In the cue and review modes, the ATF error signal mix amount is increased in terms of the alternative current in R351 and C350, so that the noise bar position in the review mode is stabilized.

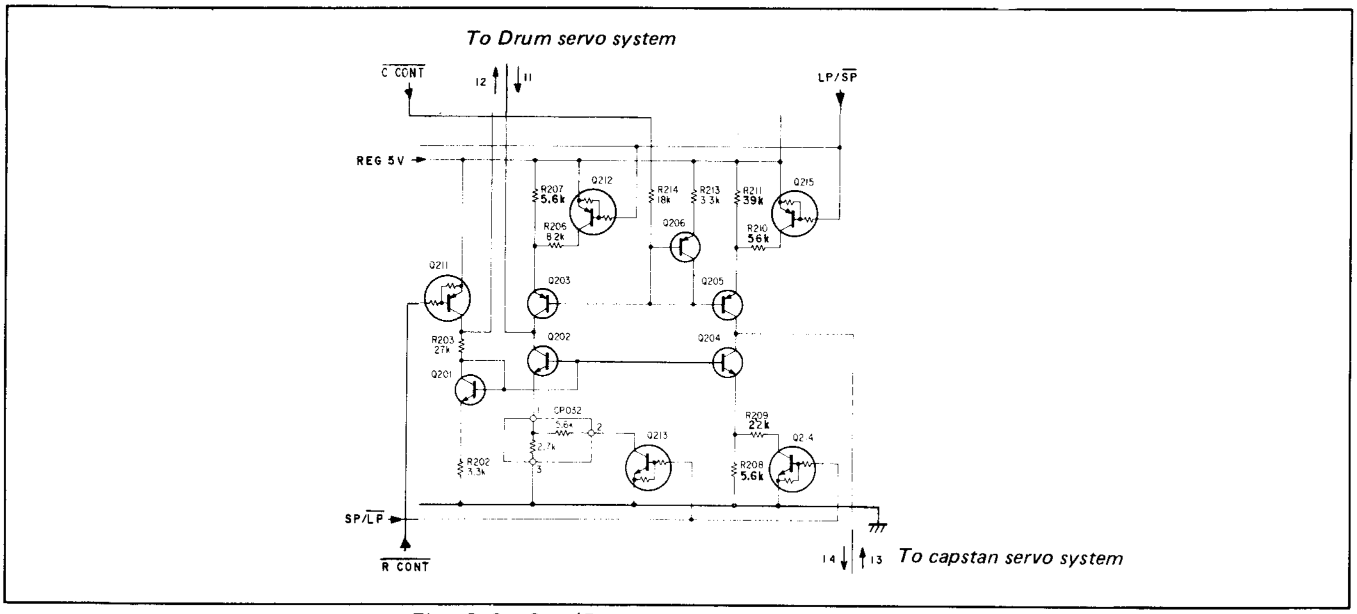


Fig. 3-9. Cue/Review Speed Correcting Circuit

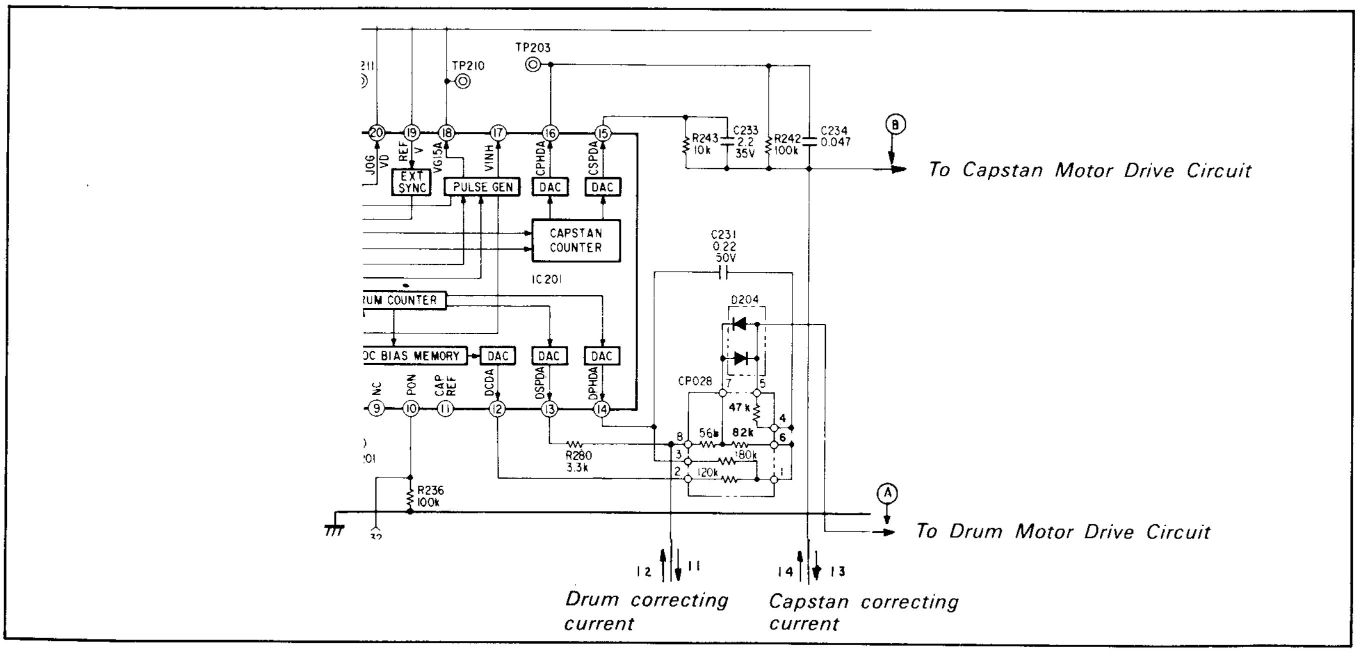


Fig. 3-10.

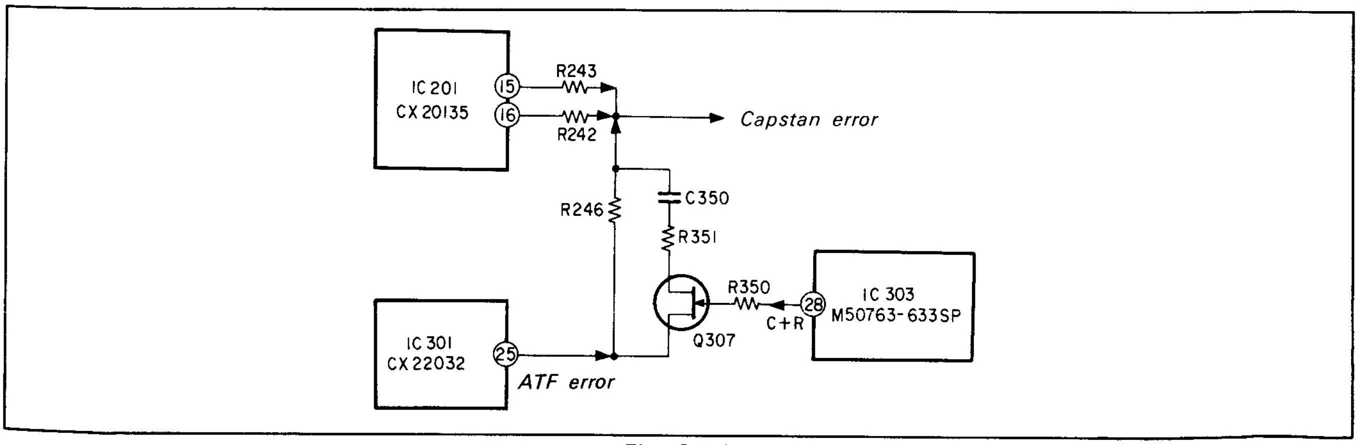


Fig. 3-11.

3-4. DRUM CAPSTAN MOTOR DRIVER (MD-8D BOARD)

3-4-1. Drum Motor Driver (MD-8D Board)

The drum motor is a sensorless three-phase one-way brushless motor. The drum motor driver IC(MD-8D board) uses CX20144 which has been developed especially for this type of motor. Following will outline the performance of the drum motor driver IC:

After processed by SS-38F/G board resistance capacitor and diodes (R280, CP28, C231, D204), the drun motor speed errpr signals and phase error signals which have been detected by means of SS-38F/G board IC201 are input into error amplifier IC (MD-8D board Pin ③ of IC004) in the form of a drum servo error signal.

The error signal is amplified linearly by means of an IC and then by means of a power transistor before admitted by the drum motor common terminal.

The motor has its U, V and W phases switched respectively by means of pins ㉒, ㉔ and ③ of the motor drive IC. The switching is timed by detecting the motor counter electromotive force. The input terminal pin ⑭ exists for this purpose. In the motor driver/motor system, a wake-up circuit is required because the motor U,V and W phase switching is carried out by means of the counter electromitive voltage being detected. C005 and R010 are responsible for the wake-up timing generation.

Consequently, even if the motor may turns a little in the reverse direction, in the wake-up stage it is not abnormal.

The application of the control-free system has eliminated the necessity of adjustment of the drum servo system, except the switch position adjustment which requires the reference tape.

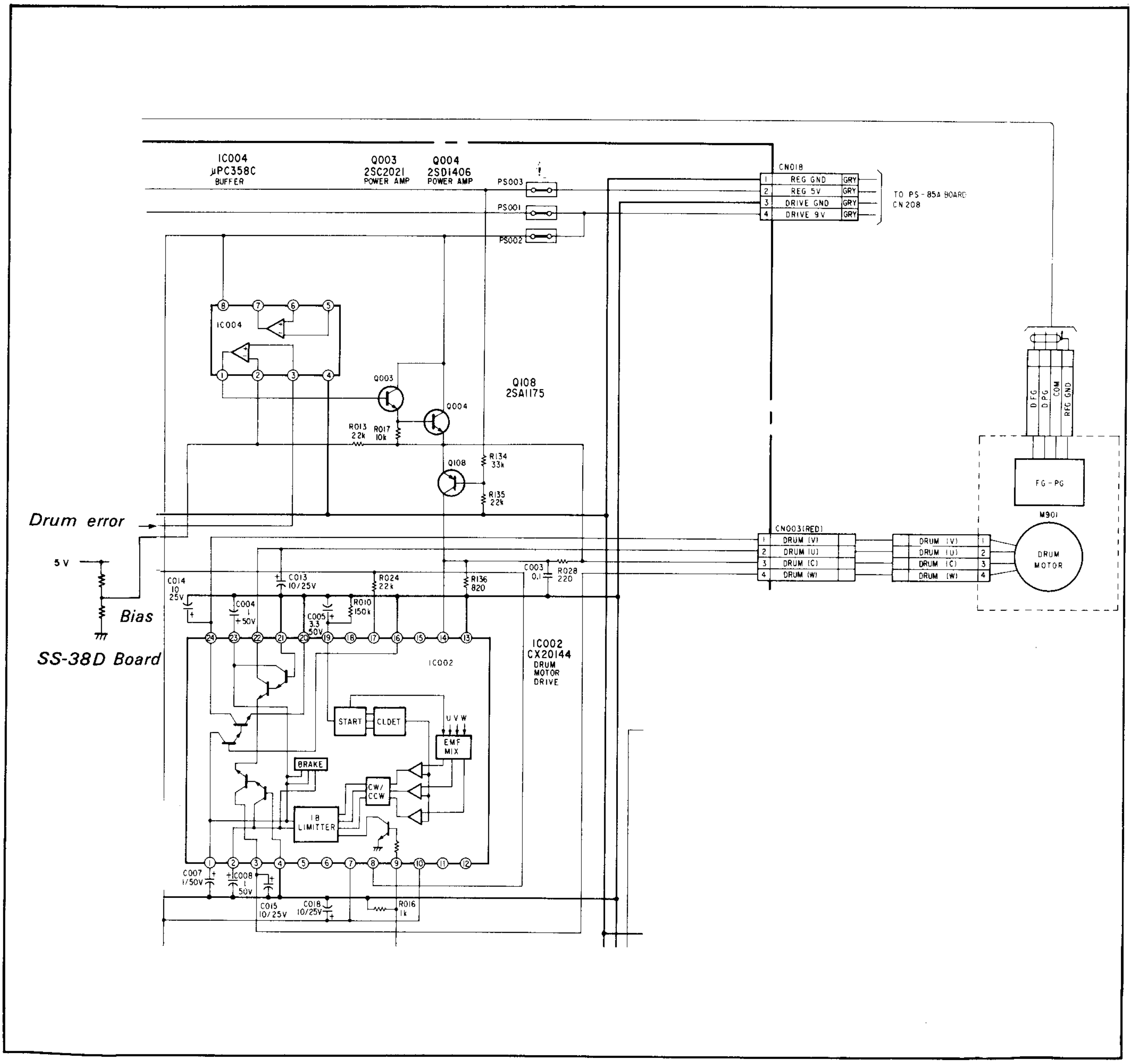


Fig. 3-12.

3-4-2. Capstan Motor Driver (SS-38F/G and MD-8D Boards)

The capstan motor is a three-phase bothway brushless motor, which carries out the U, V and W phase switching by detecting the rotor position by the use of three Hall elements. CX20136 (MD-8D board IC001) is an IC developed for the three-phase bothway motor driver and composed of the above-mentioned Hall element sensor amplifier, servo error amplifier, PWM generating circuit and U, V and W phase switchers.
The capstan servo error signal which has been detected by means of the capstan servo circuit is amplified by means of IC 203 (Pins ⑤, ⑥ and ⑦) of the SS-38F/G board. The amplifier serves to produce the AC gain in the cue and review modes and the gain is switched by means of analog switch IC204 (Pins ⑩ and ⑪).

IC203 (Pins ①, ② and ③) serves as a buffer amplifier for generating the DC bias voltage, and thereby DC bias voltage is dependent on RV201 (SP mode) or RV202 (LP mode). Meanwhile the gain in capstan motor driver IC (MD-8D board IC007) is dependent on R004. R025 is an element for correcting the frequency characteristics.
The capstan servo error signal is amplified linearly by means of the amplifying circuit in the driver IC (IC001) and then output to pin ㉒. It is then input into IC001 after current amplification (pin ⑮) by means of the power transistors in Q001 and Q002 and supplied to U, V and W of the capstan motor.
The drum and capstan driver ICs incorporate PWM generating circuits to ensure the PWM drive. This time, however, they are not in use from the point of cost curtailing consideration and the fear of noise influence.

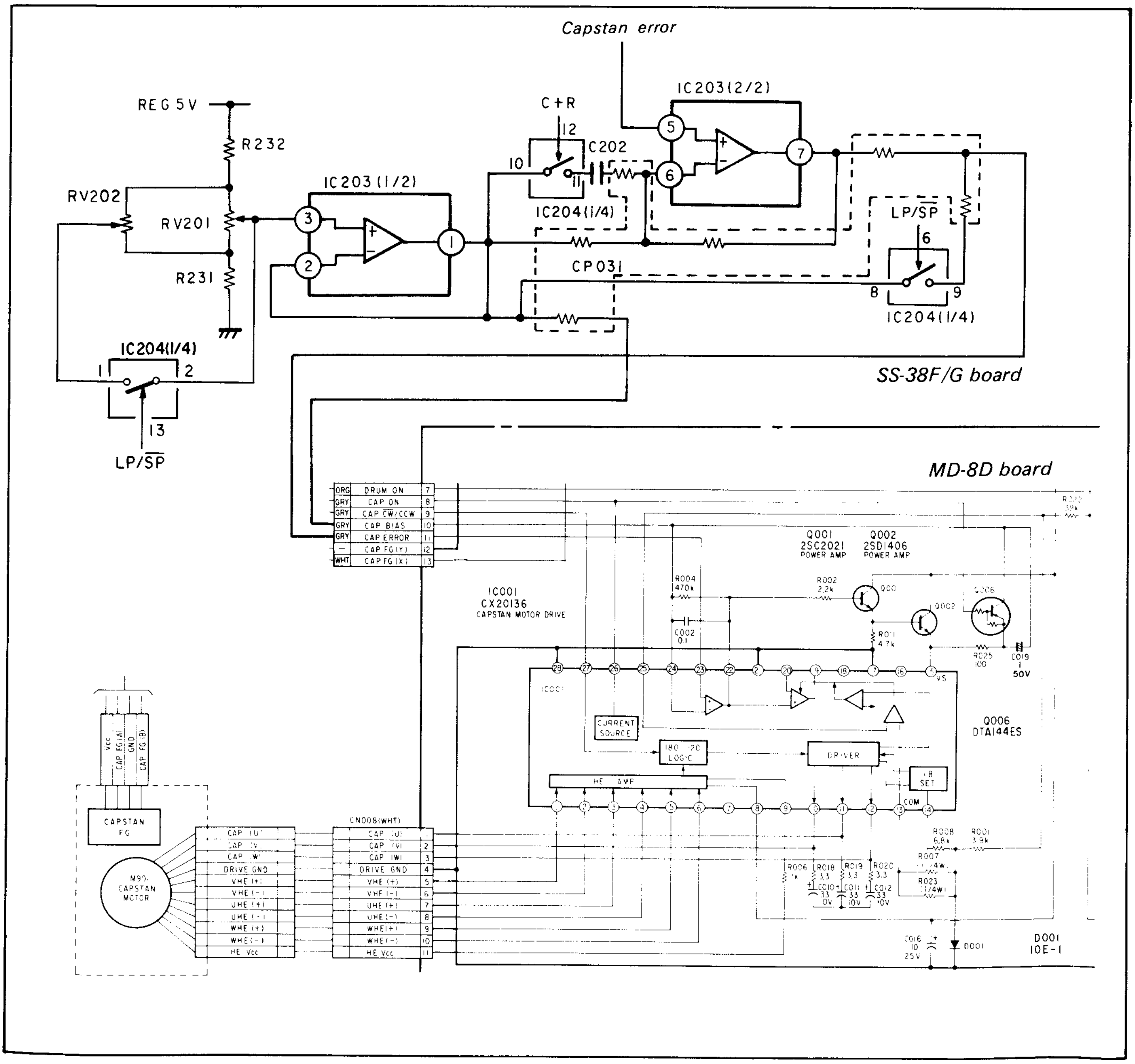


Fig. 3-13.

3-5. ATF SERVO (VI-9A AND SS-38F/G BOARD)

The ATF servo system is controlled by means of the system control (SS-38F/G board. IC101).
The following will explain the control:

1. ATF pilot selection (SS-38F/G board IC – IC305 – VI9A board IC005).
   [Control signal] SEL 1 SEL 2
2. ATF error sample/Hold and ATF lock sample/Hold (SS-38F/G board IC101 – IC301)
   [Control signal] TSA. TSB.
3. Latch lock detection (SS-38F/G board IC301 – IC305 – IC101).

3-5-1. Outline of ATF Servo

Four pilot signals f_1 to f_4 (ATF PILOTS) are processed by means of a rotary video head as the capstan phase servo control signals for the video signal and subjected to frequency multi-recording. In the playback mode, the capstan phase servo is performed by the aid of the signal.
Table. 3-1. shows the pilot signal and Fig. 3-14. indicates the pilot signal frequency interleaving.

Pilot	Control		Frequency
	SEL1	SEL2	
f_1	1	1	101.024 kHz (375/58 f_H)
f_2	0	1	117.188 kHz (375/50 f_H)
f_3	1	0	162.760 kHz (375/36 f_H)
f_4	0	0	146.484 kHz (375/40 f_H)

Table 3-1.

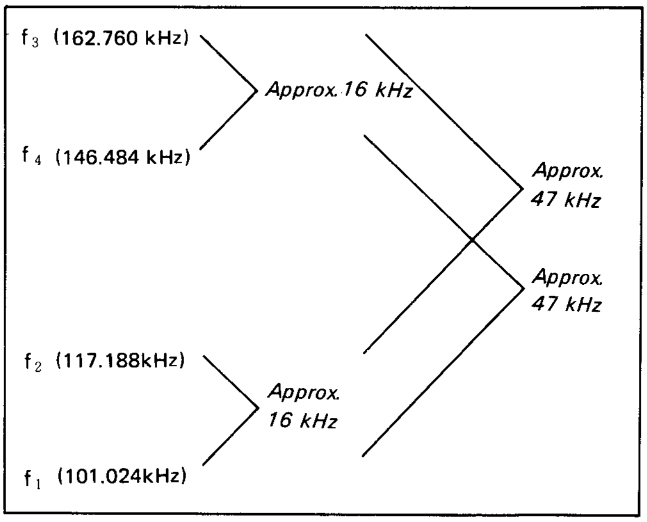


Fig. 3-14. Pilot signal frequency interleaving

3-5-2. Recording Format

Pilot signals, f_1, f_2, f_3 and f_4, are individually recorded in the track successively, Fig. 3-15, such a way that the frequency difference between tracks is about 16 kHz or 47 kHz.

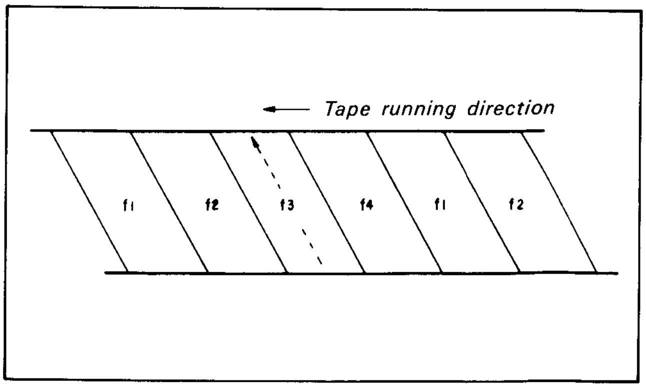


Fig. 3-15.

3-5-3. Playback Principle

The leakage of pilot signals in the adjacent tracks are detected and the capstan phase servo is applied so that the leakage magnitudes become almost uniform. In other words, the played back ATF pilot signal (record pilot) undergoes the balanced modulation by the use of the REF (Reference) pilot signal. Here, two types of beats, i.e., about 16 kHz and 47 kHz, will occur in the adjacent tracks. Therefore, the capstan motor should be controlled by means of the capstan phase error signal so that two beat levels may become equal, in such a way that the track center is properly traced.
The capstan phase error signal is called "ATF error signal".
For example, during playback of f_1 track, ATF pilot signals of f_2 and f_4 are played back as leakage components together with playback of the AFT pilot signal of f_1. The following 2 beats are generated in between these leakage components and the REF pilot signal (in this case f_1).
$f_2 - f_1$ = approx. 16 kHz
$f_4 - f_1$ = approx. 47 kHz
Between the two beats, the 16 kHz is called adjacent advancing beat and it becomes strengthered when the video head is advanced against the normal position on the tape.
The other beat of 47 kHz is called the adjacent delay beat, and it becomes strengthened when the video head is delayed against the normal position on the tape.
However, this relation becomes inverse when f_2 and f_4 tracks are used. For this reason, the 1 kHz and 47 kHz BPF is switched over in the case when using f_2 and f_4 tracks.

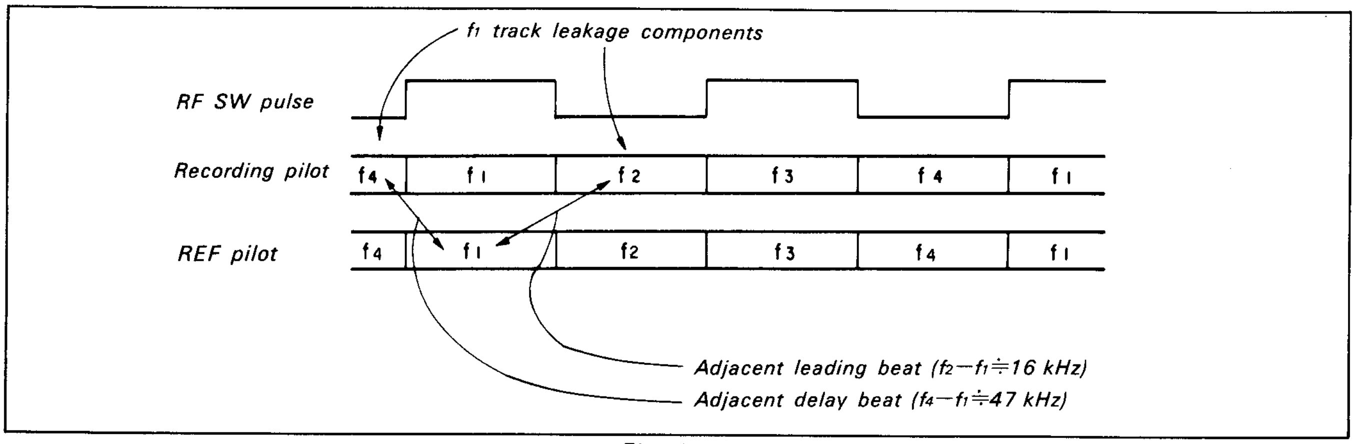
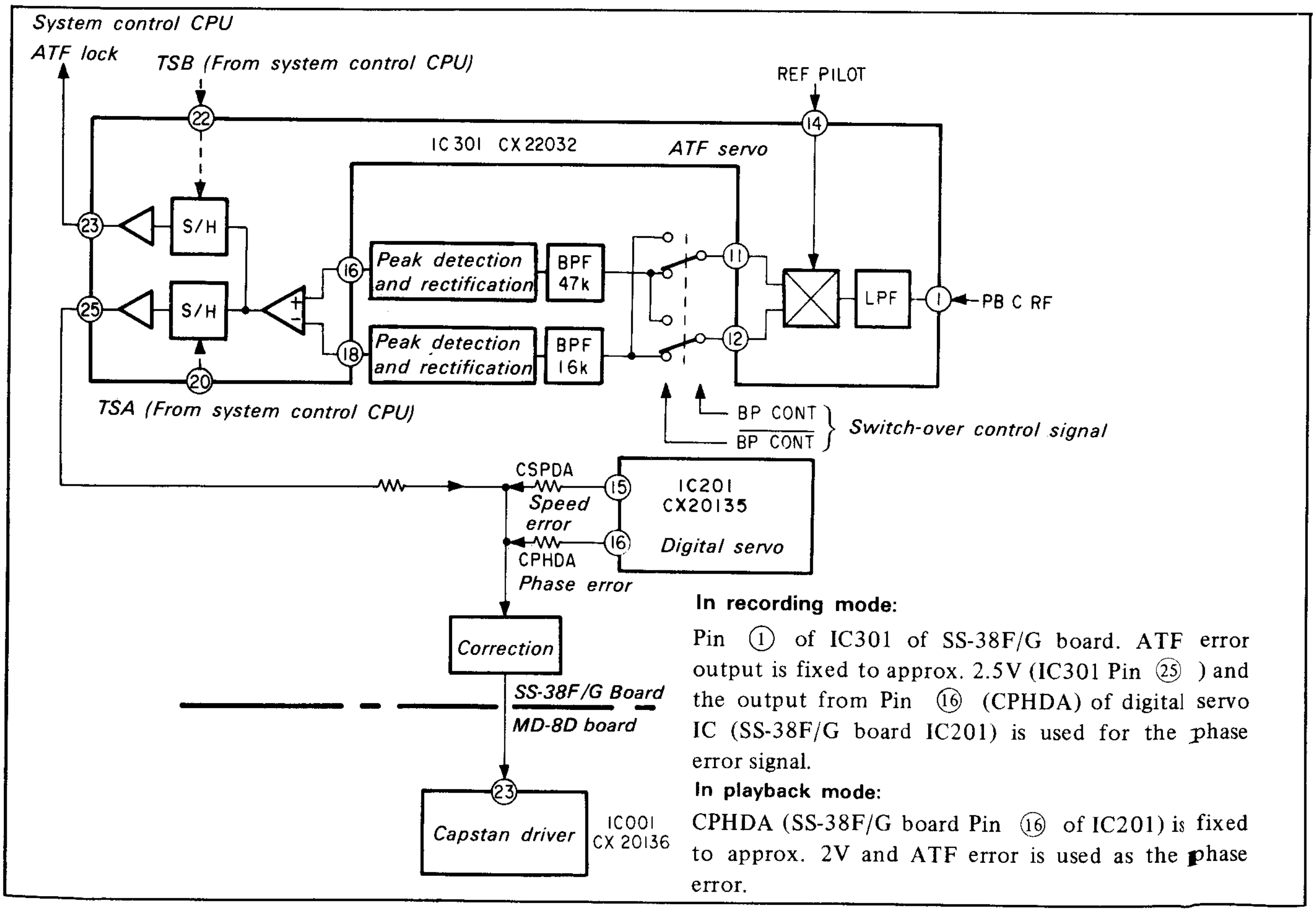


Fig. 3-16.



In recording mode:

Pin ① of IC301 of SS-38F/G board. ATF error output is fixed to approx. 2.5V (IC301 Pin ㉕) and the output from Pin ⑯ (CPHDA) of digital servo IC (SS-38F/G board IC201) is used for the phase error signal.

In playback mode:

CPHDA (SS-38F/G board Pin ⑯ of IC201) is fixed to approx. 2V and ATF error is used as the phase error.

Fig. 3-17. ATF servo block diagram

3-5-4. Normal Playback

In practice, the playback entails the REF pilot signal time division, Fig. 3-18, with capstan playback phase error detection and phase lock detection.

AS long as TSA stays in "L" level, the phase error detection continues. As long as TSA stays in "H" levle, the detected phase error voltage is held.
When TSB is in "L", the phase lock is detected.
As long as TSB stays in the "H" level, the detected phase lock is held.

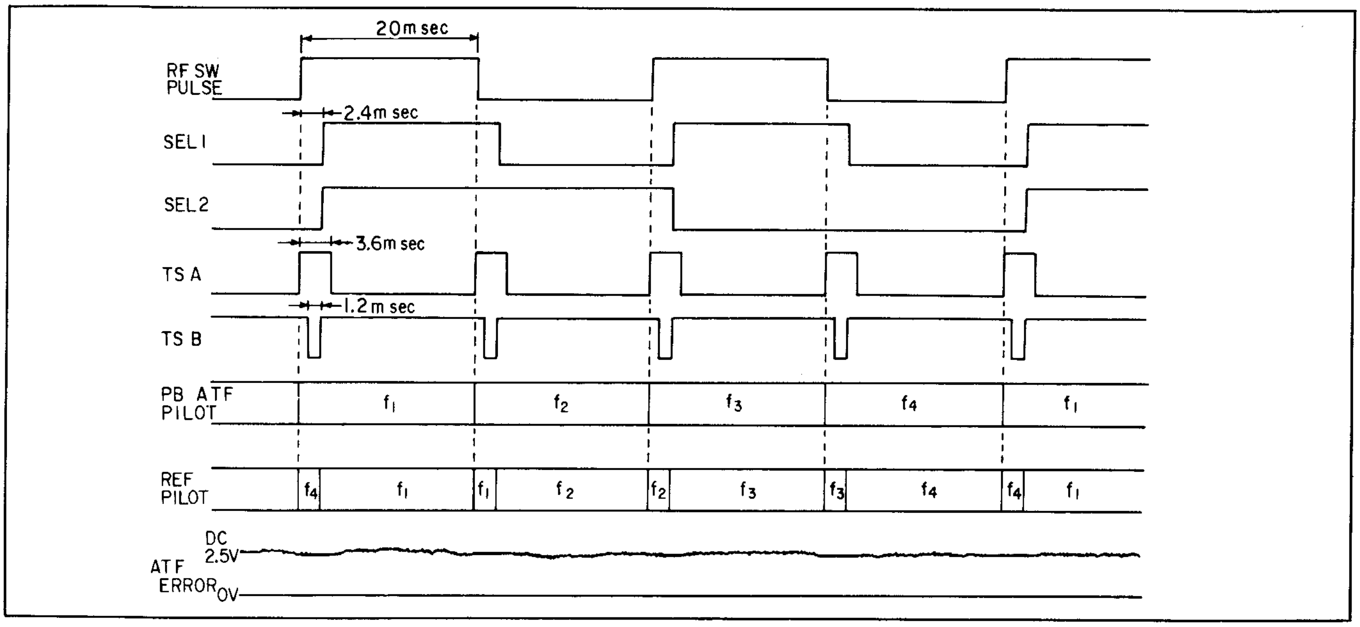


Fig. 3-18.

3-5-5. Cue (×9) Playback:

CH1 noise position is overlapping the CH2 noise position. The noise near the vertical synchronization signal (CH1/CH2 switching position) is out of the image and hence it seems as if three noise bars were present.

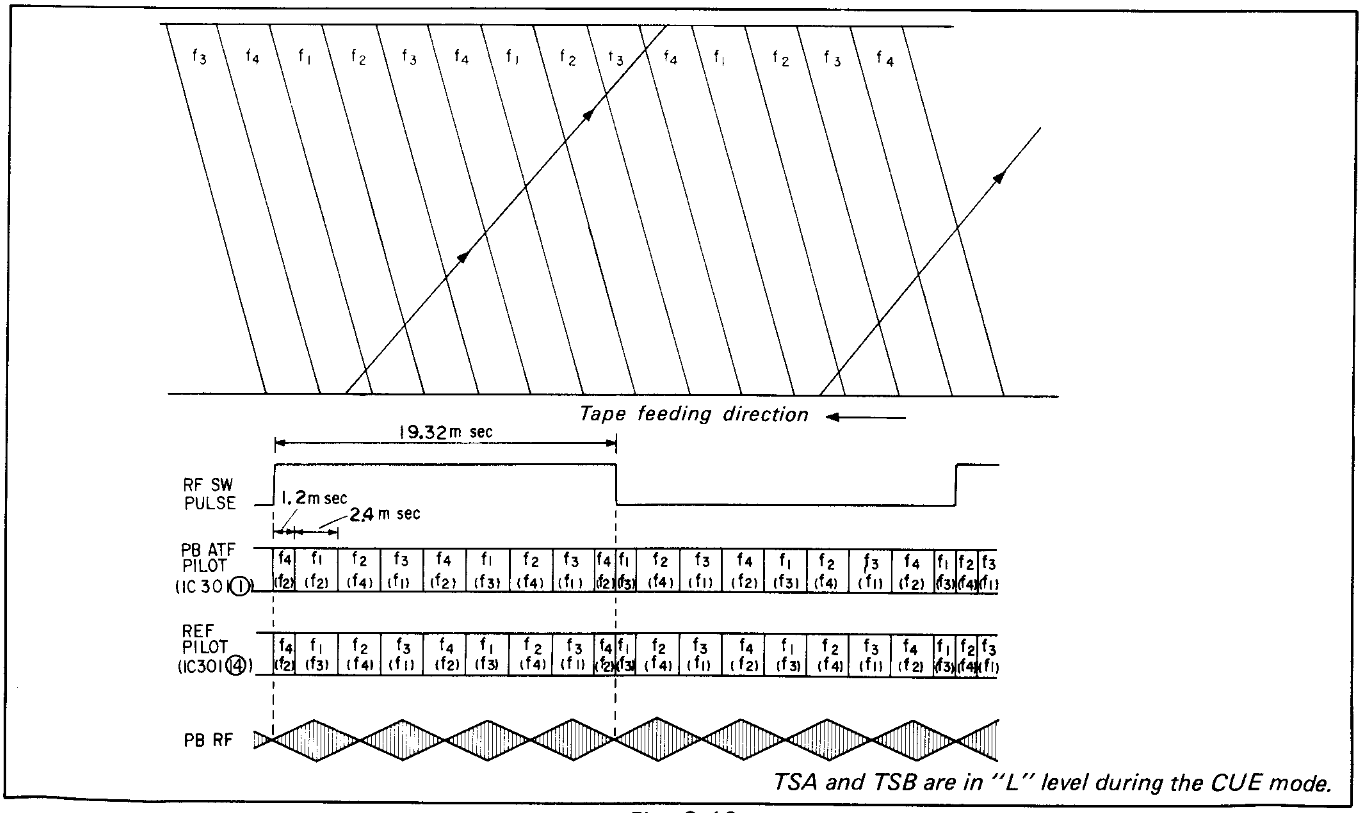
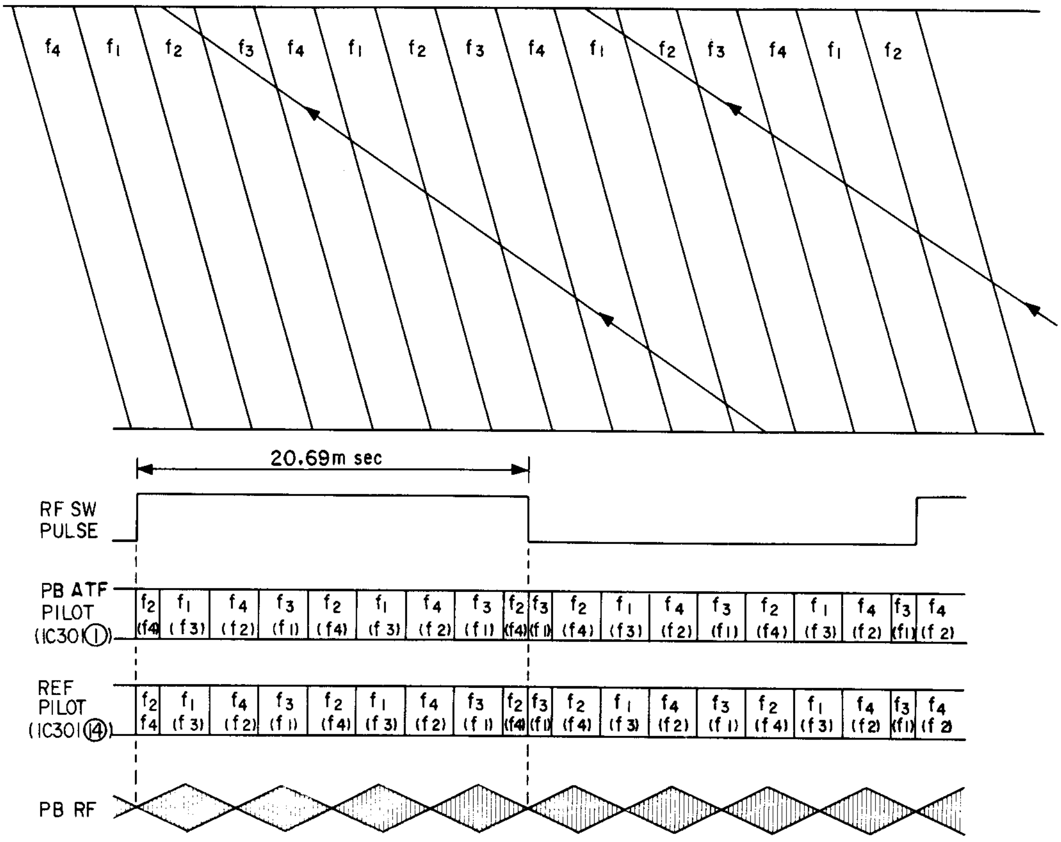


Fig. 3-19.

3-5-6. Review (×−7) Playback

CH1 noise position is overlapping the CH2 noise position. Since also the noise near the vertical synchronization signal (CH1/CH2 switching position) is out of the image and hence it seems as if three noise bars were present.



TSA and TSB are always in "L" position during the REV mode.

Fig. 3-20.

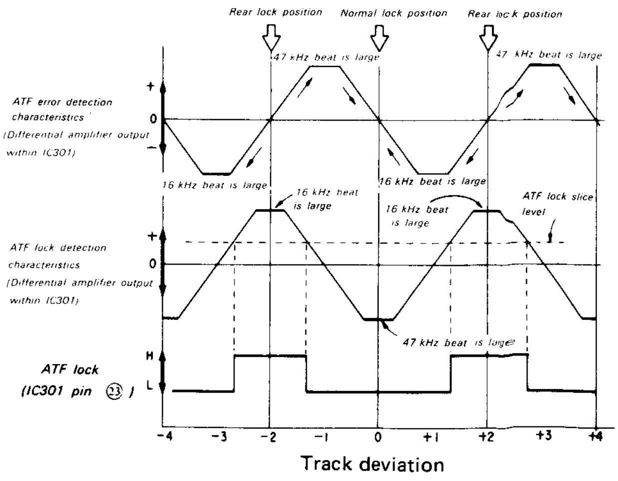
3-5-7. Process Using ATF Lock Signal

[Phase lock detection procedures]

In the normal playback, REF pilot signal frequency should be a pilot frequency delayed by a track (one field) with respect to the ATF error detecting pilot frequency for 2.4 msec immediately after the RF SW pulse changeover (playback track switchover).

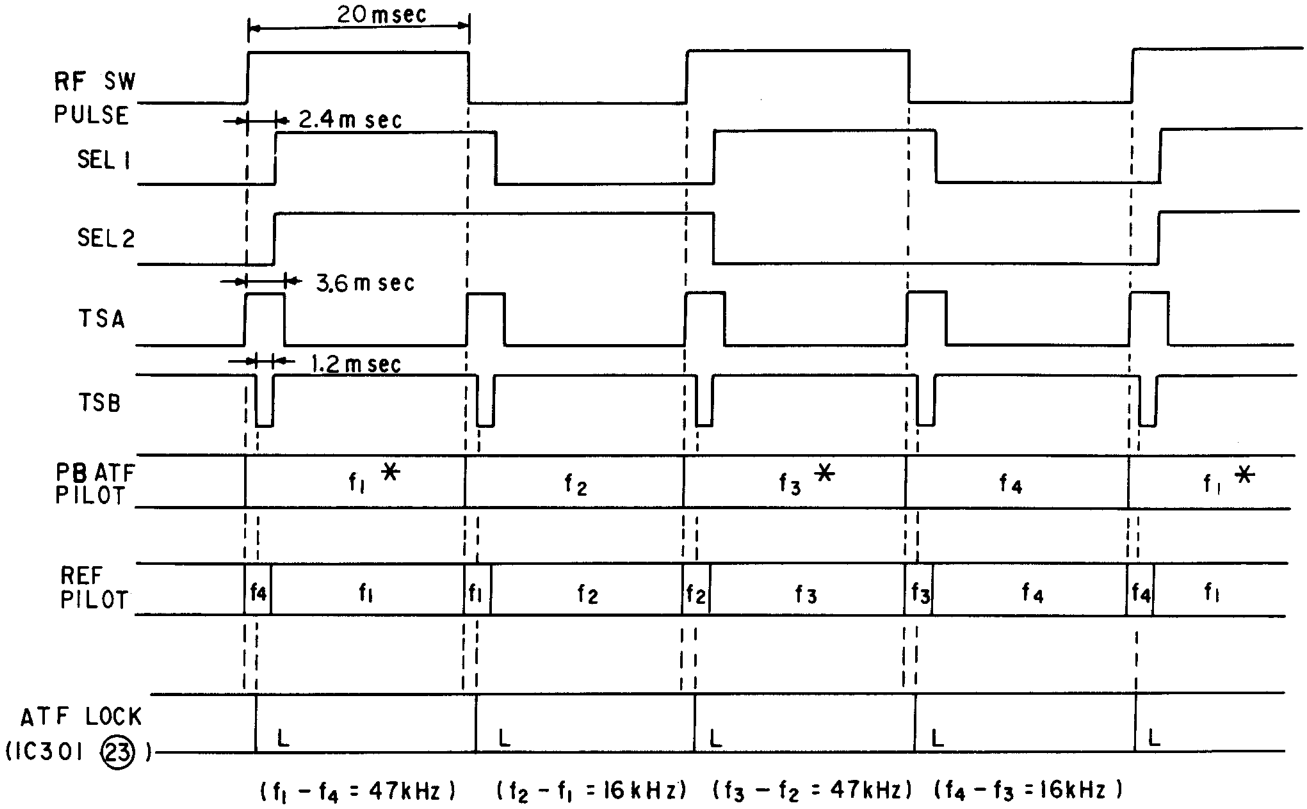
Here, the beats are directly produced by the playback pilot signal (recording pilot signal) and the REF pilot signal (in the case of normal phase leck, a 16kHz beat is produced when f2, f4 track is played back and a 47kHz beat is produced when f1, and f3 traks are played back).

The phase lock is judged by detecting this beat. The ATF lock detection timing chart during normal playback is as shown in Fig.3-22. The ATF lock detection characteristics are as shown in Fig.3-21.



- Detection characteristics in f_1 and f_3 track playback. In the case of f_2 and f_4 track playback, the 16 kHz and 47 kHz frequencies change places.

Fig. 3-21.



- In the case of track playback (* marked) and the track playback (no mark), the 47 kHz BPF and 16 kHz BPF are positioned reversely. Consequently, in the case of* marked track playback, if the 47 kHz beat is large, the ATF lock is in the "L" position. In the case of no-mark track playback, if the 16 kHz beat is large, the ATF lock is in the "L" level.
- The AFT lock (phase lock) is detected as long as TSB stays in the "L" level but held when TSB is in the "H" level.
  In the case of a normal phase lock, ATF lock signal is "L".

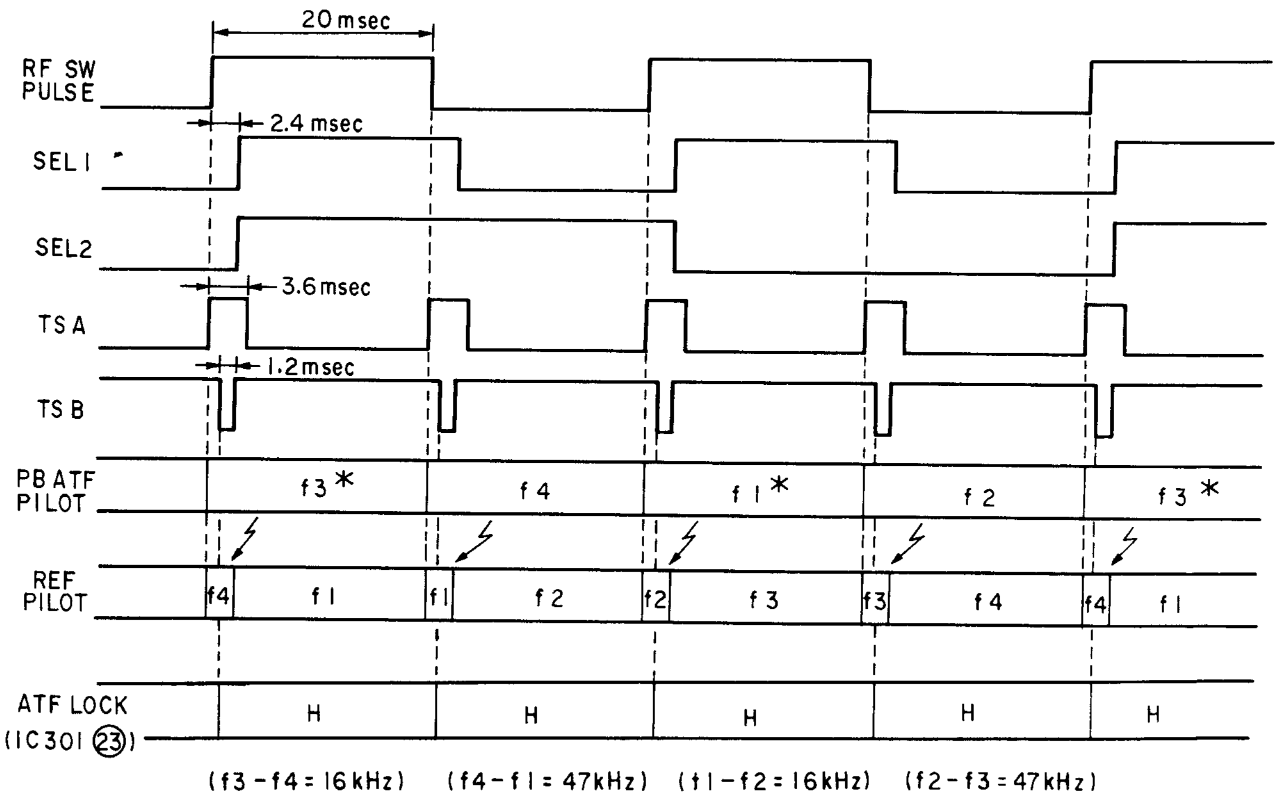
Fig. 3-22.

(1) Rear lock detection

In the case of a two-track deviation, the AFT error signal alone cannot prevent a mis-lock. (Fig. 3-21. AFT error detection characteristics). To prevent the mis-lock, the rear lock detection is carried out. Fig. 3-23. represents the timing chart in the case of a two-track deviation.

In the case of a two-track deviation,as long as TSB is "L", the direct beats of the recording pilot signal and the REF pilot signal is 16kHz when playing back f_1 and f3 tracks, and 47kHz when playing back f2 and f4, with ATF lock signal at "H". This state is called the rear lock state.

Here, the REF pilot signal frequency is advanced by two fields so that the phase lead-in time may become shortened.



• In the case of * marked track playback and no-mark track playback, 16 kHz BPF and 47 kHz BPF change places.

Fig. 3-23.

(2) SP/LP speed identification

In the case of SP mode playback of the tape which has been recorded in the LP mode, Fig. 3-24. shows the relationship between the REFERENCE pilot and the PB ATF pilot, (b) and (c), where the output of multiplication of TSB in "L" level (hold in "H" level) is indicated in (e).
Subsequently, in the case of passing the signal (E) to the level comparator, the signal becomes the AFT LOCK signal, (f).
In the case of LP mode playback of the tape which has been recorded in the SP mode, Fig. 3-25. shows the relationship.
The ATF lock signal is read in by the system-control microcomputer (SS-38F/G board IC101) at a TSB lead per field and is used to identify the tape speed on the basis of a unit representing12 fields.

SP mode playback:
If ATF lock is 1X0X1X0X1X0X, it is shifted to LP mode.

LP mode playback:
If ATF lock is 11xx00xx11xx, it is shifted to SP mode.

Note: "X" bits should be ignored.
"1" or "0" may be accepted.

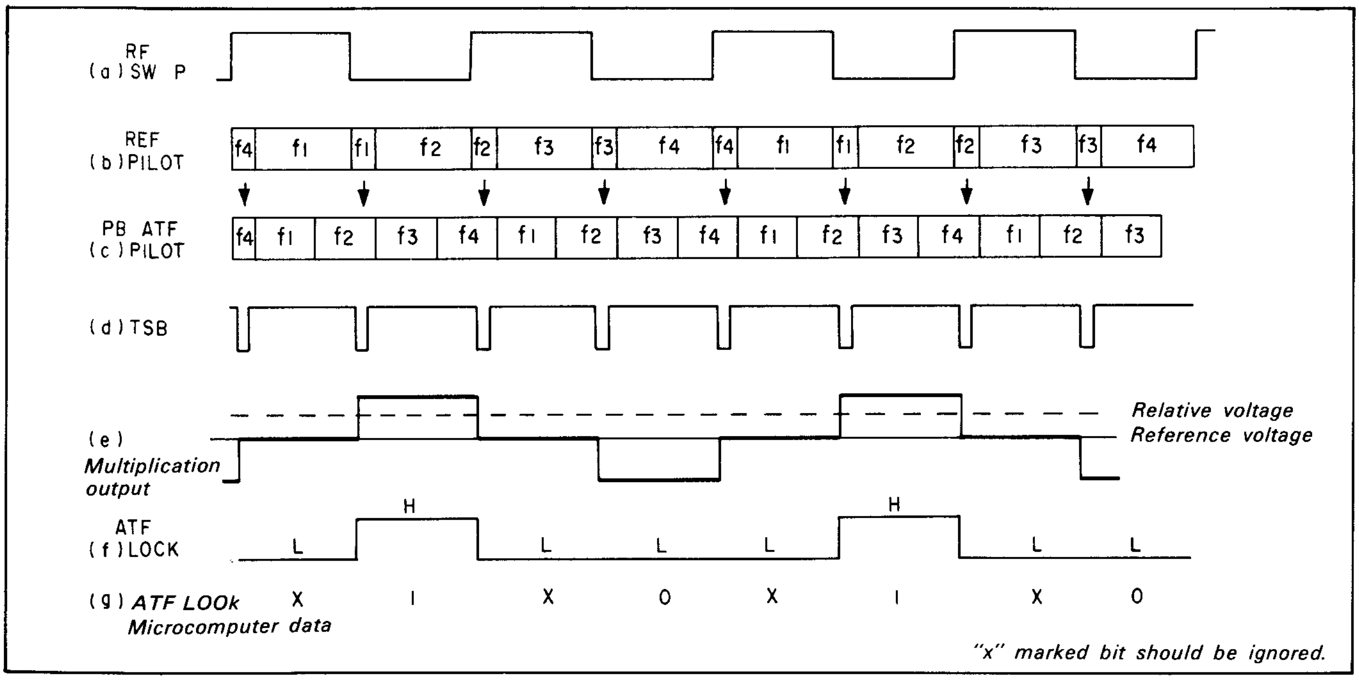


Fig. 3-24. When LP mode recorded tape is played back by SP mode

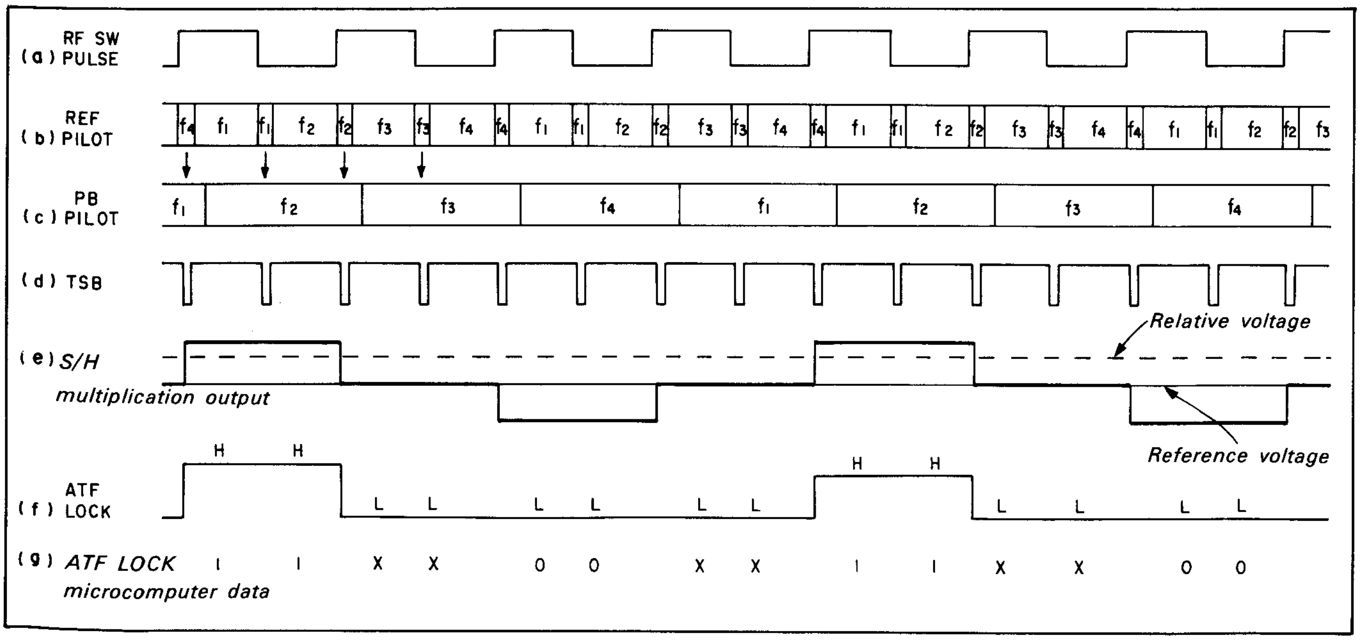


Fig. 3-25. When SP mode recorded tape is played back by LP mode

3-5-8. ATF Circuit Operation

Four pilot signals f_1 to f_4 which have been frequency multi-recorded on the tape with Y-FM signals used as bias are input together with the playback chroma signals as PB Y signals into Pin ⑫ of IC007 of the VI-9A board. (Fig. 3-26.)

The PB C signal which has been input into IC007 is first input into LPF through the buffer TR3 in the IC so that the unnecessary components, e.g., chroma signals, Y signals, etc.may be eliminated. The LPF is a secondary LPF (fc = 270kHz) consisting of R280, L209 and C270 which are externally mounted on pins ⑩ and ⑮ . Then the signal is amplified by means of an amplifier consisting of TR1 in the IC007 to 10–20 dB, and at the same time, used to correct the differential characteristics of the tape/head systems within the pilot signal frequnency band (100kHz–170kHz) by virtue of the integral characteristics of –60 dB/Oct. over 100kHz of LPF (fc = 70kHz) consisting of C5 and R4.

The signal is input, after the band limit and the characteristics correction are given, into pin ① of IC301 in SS-38F/G board (Fig.3-27). The the higher band undesirable components are eliminated in the active tertiary LPF (Fc = 220 – 300kHz) in the IC, amplified by about 34 dB, and then balance modulated by means of the reference pilot signal input into pin ⑭ .

When playing back f1 and f3 tracks, the balance modulator's loads are BPF FL301 of pin ⑪ and BPF FL 302 of pin ⑫ . The two BPFs are produced in the LC parallel resonance circuit respectively with the resonance frequency of 47kHz (FL301) and 16kHz (FL302). Consequently, in the balance modulator, the crosstalk components from the adjacent track (ad-jacent track pilot signal) and the beat components of the reference pilot signal (16kHz and 47kHz) only are eliminated and an approximate 20 dB amplidication is attained. The beat components of 16kHz and 47kHz are respectibely detected by IC302 (H8D 1756) and input into Pin ⑱ and Pin ⑯ . It means therefore that the advance of the video head phase with respect to the playback track on the tape leads to DC voltage increase in Pin ⑱ (16kHz wave detection output), meanwhile, delay in the video head phase leads to the DC voltage increase in Pin ⑯ (48kHz wave detection output). The differential amplifier in the IC takes the difference between the two wave outputs into consideration and uses it as the ATF error signal.

As precedingly explained, however, 16 kHz beat level variation and 47 kHz beat level variation become opposite to each other in their characteristics due to the video head phase deviation with respect to the playback track on the tape in the f_1 and f_3 track playback and f2, f4 track playback. Consequently FL301 and FL302 are changed over by the B CONT signal and B CONT signal. Q301 to 304 are the FETs which serve to switch the BPF.

The differential amplifier output is divided into two sample and hold circuits; namely, S/HA and S/HB. This is in order to obtain ATF error signal of 2 systems by applying time division to the reference pilot signal.

In this system, ATF lock signal of the rear lock judgment and LP/SP automatic judgment together with the capstan servo phase error signal are obtained.

After sample and hold by S/HA circuit, the capstan servo phase error signal is amplified approximately 18 to 20 dB and output from pin ㉕ . This signal is mixed with the capstan speed error signal of SS-38F/G board and sent ot the capstan motor driver of MD-8D board.

The dynamic range of the capstan servo phase error signal output (pin ㉕ of IC301) is approximately 0.8V dc to 4.0V dc. When phase lock of the servo phase error signal is released, the error signal output goes up and down within this range.

The ATF lock signal is sent from pin ㉓ to the system control CPU (IC101) of SS-38D board through the hysteresis amplifier, after sample and hold.

Furthermore, the sample and hold timing of S/H A and S/H B circuits is controlled by TSA and TSB signals.

When these signals are "H", the preceding level is held.

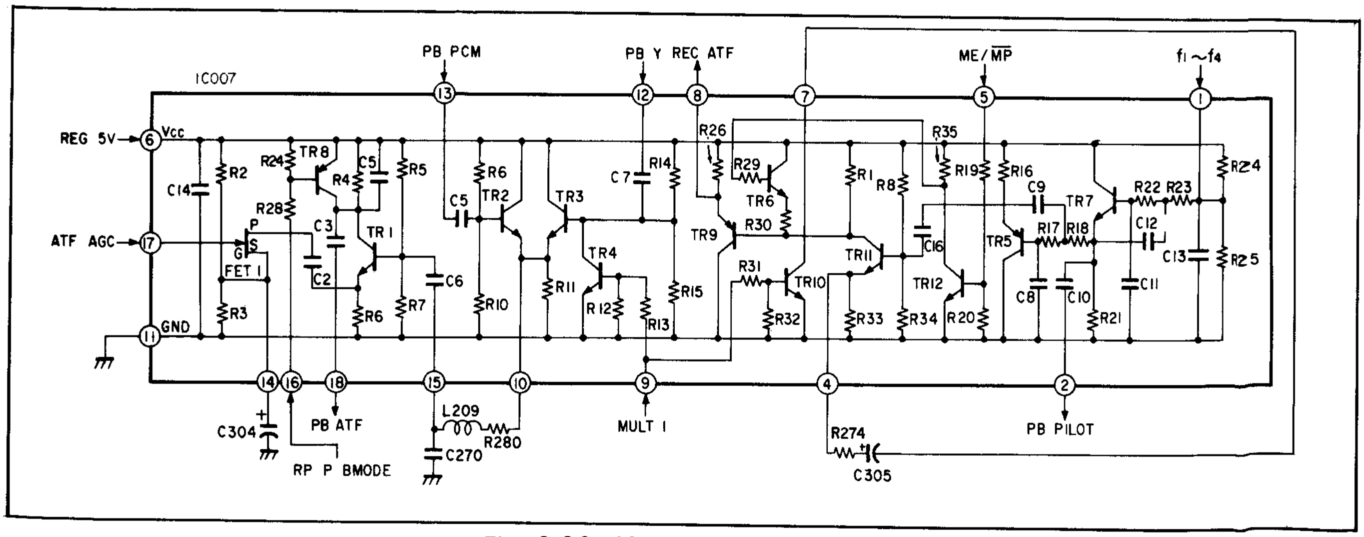


Fig. 3-26. IC007 equivalent circuit

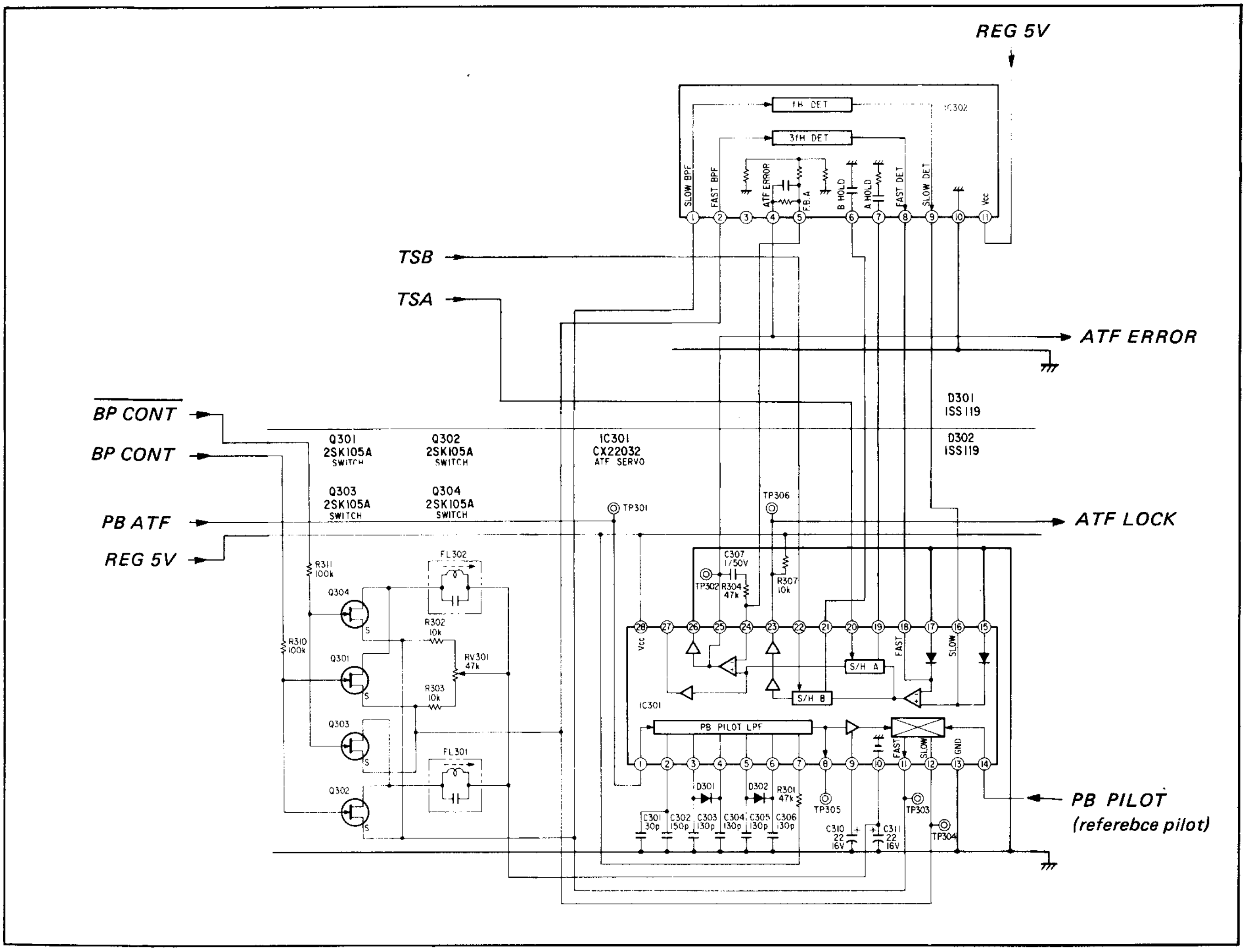


Fig. 3-27.

3-6. VARIABLE SPEED SERVO (STILL-, STEP- AND SLOW-PLAYBACK)

The variable speed servo system is controlled by means of a system control CPU (SS-38F/G board IC101) and the servo control (SS-38F/G board IC303). The following will describe the control deteils:

1 AFT pilot control:
  (Control signal) SEL1 and SEL2.
2 Pilot memory in the mode shifting process:
  (Detection signal) CAP ON 1
  (Control signal) TSB
3 Capstan intermittent drive:
  (Control signal) CAP DRIVE and CAP RVS.
4 Chroma system PS switchover:
  (Control signal) VA SWP
  Double azimuth head switching:
  (Control signal) H.CHG.
5 Slow f_H correction.

3-6-1. ATF Pilot Control

(Control changeover)

$\overline{\text{DOSYNC}}\cdot\overline{\text{SPAUSE}}$ switches the AFT pilot selective signal SEL1 and SEL2 modes to the system control CPU mode or the servo control CPU mode (Fig. 3-28. Table 3-2.)

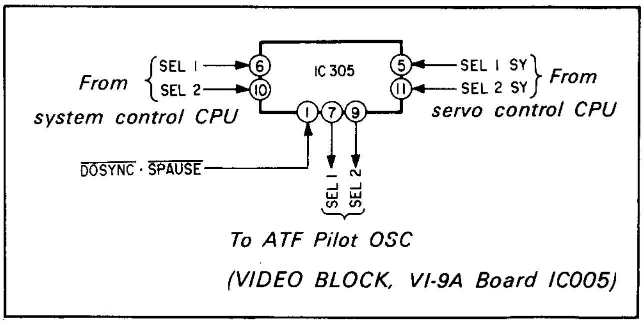


Fig. 3-28.

$\overline{\text{DOSYNC}}\cdot\overline{\text{SPAUSE}}$	SEL1 (IC305 ⑦), SEL2 (IC305 ⑨) output
H	System control CPU mode
L	Servo control CPU mode

Table 3-2.

ATF Pilot

[PB – STILL]

In the playback mode, pressure on pause button switches moves the $\overline{\text{SPAUSE}}$ signal from "H" to "L" in the course of playing back track shifting from f_4 track to f_1. As a result, the ATF Ref pilot is controlled by means of SEL 1 and SEL 2 signal from the servo control CPU.

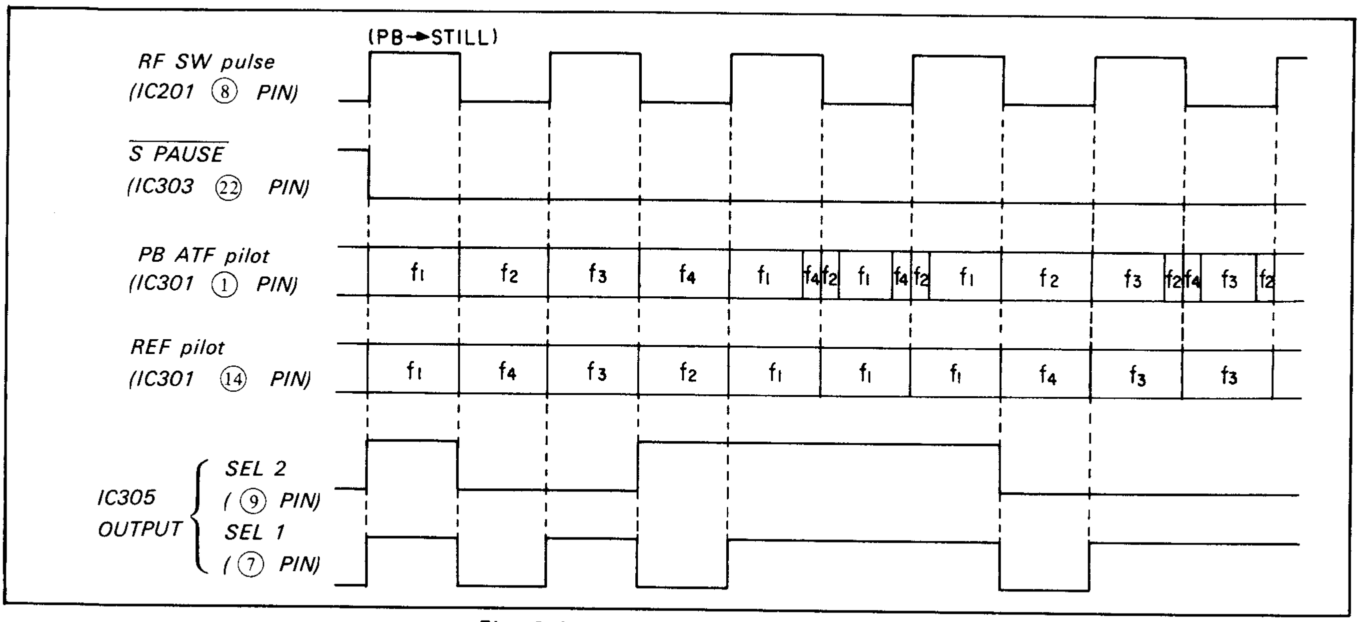


Fig. 3-29. PB→STILL Timing Chart

STEP

ATF pilot is controlled by SEL1 and SEL2 signals from servo control CPU.

Slow

Step feed is carried out per five frames.
Consequently, like the STEP mode, the control is carried out by means of the servo control CPU SEL 1 and SEL 2 signals.

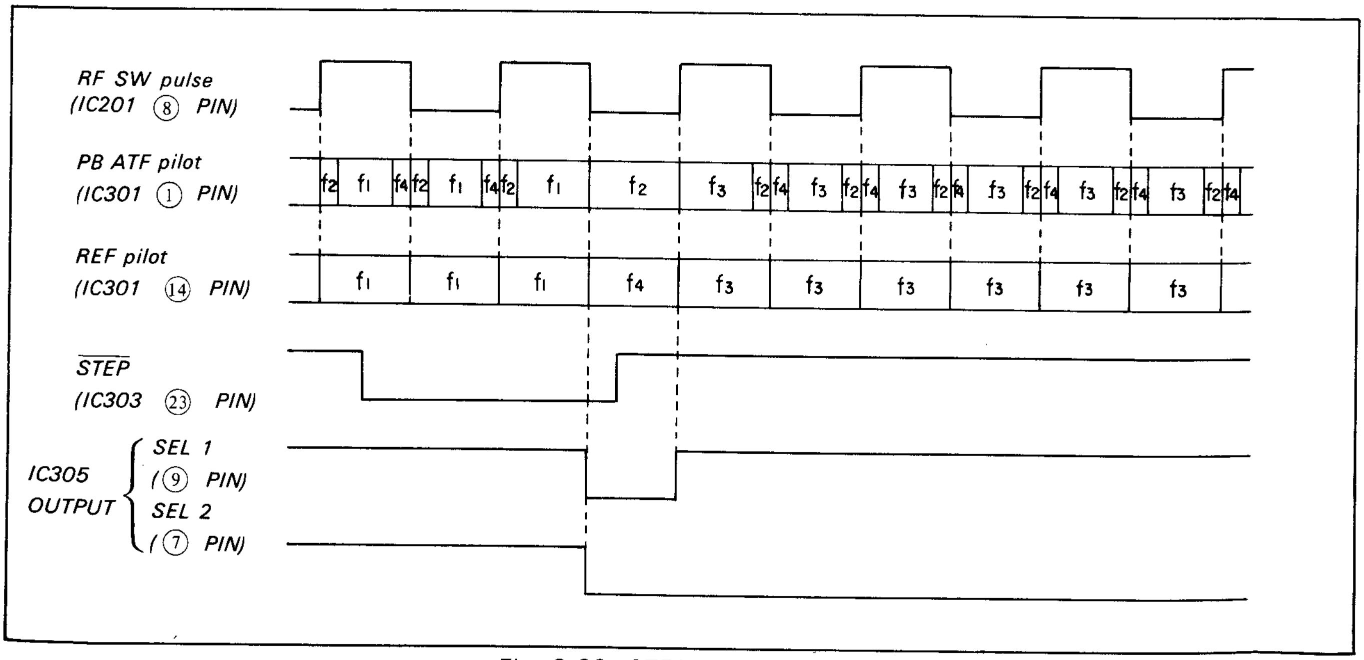


Fig. 3-30. STEP Timing Chart

3-6-2. Pilot Memory in Mode Shifting

After the $\overline{\text{SPAUSE}}$ signal has been shifted to "L", servo control CPU will control the ATF pilot.
Consequently, when the $\overline{\text{SPAUSE}}$ signal returns to 'H' and PB mode is reached, the system control CPU should memory whether the f1 field is still leading or the f3 field is still. Otherwise, the PB Ref pilot continuity will be lost. To prevent such a situation from taking place, the $\overline{\text{SPAUSE}}$ signal is positioned to "L" and the CAP ON 1 signal is transmitted in the period over which STILL, STEP or SLOW operation is carried out from servo control CPU to the system control CPU, so that the moved frame number may be notified. CAP ON 1 signal is detected in the leading edge of TSB signal used for detecting the ATF lock.

The system control CPU detects the variation of CAP ON 1 signal from level "L" to level "H", and causing SEL2 signal to reverse. SEL 1 signal keeps staying in "H" as long as $\overline{\text{SPAUSE}}$ signal stays in 'L', without any variation.

(PB → STILL)

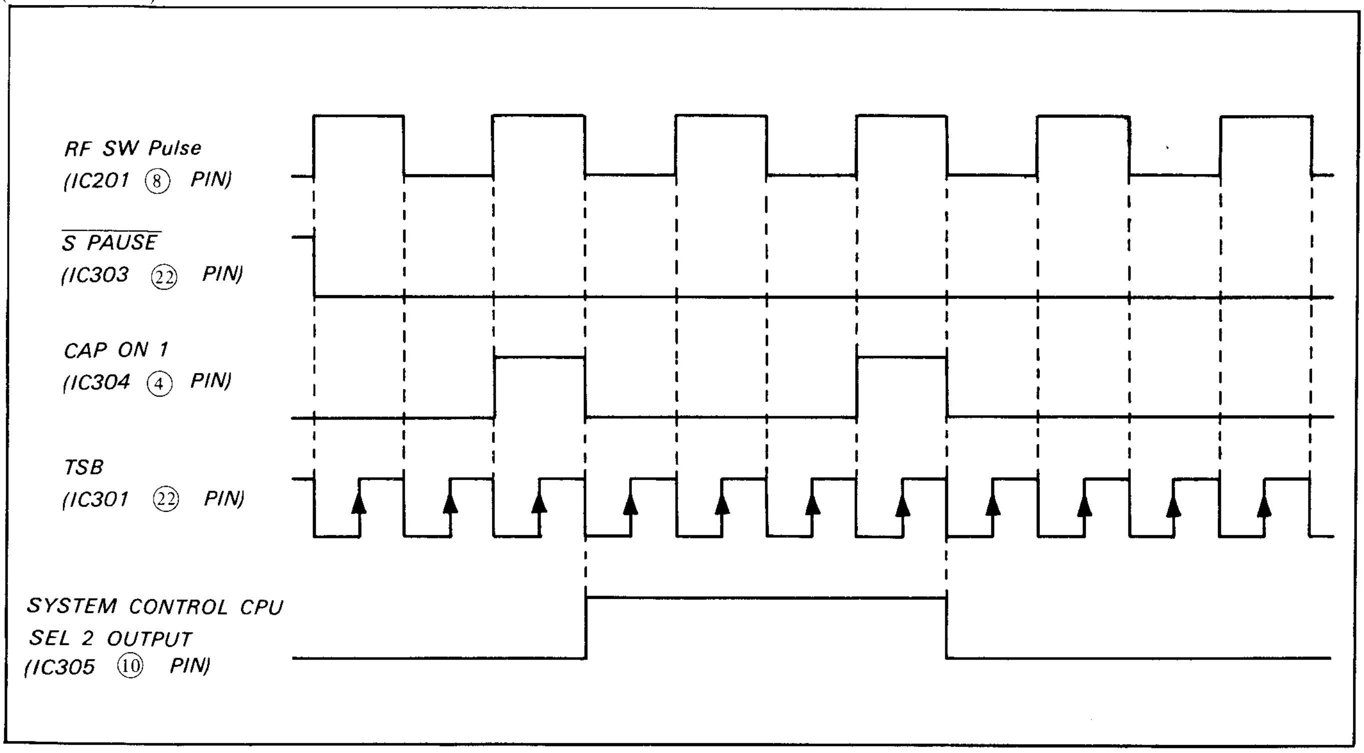


Fig. 3-31.

(STEP)

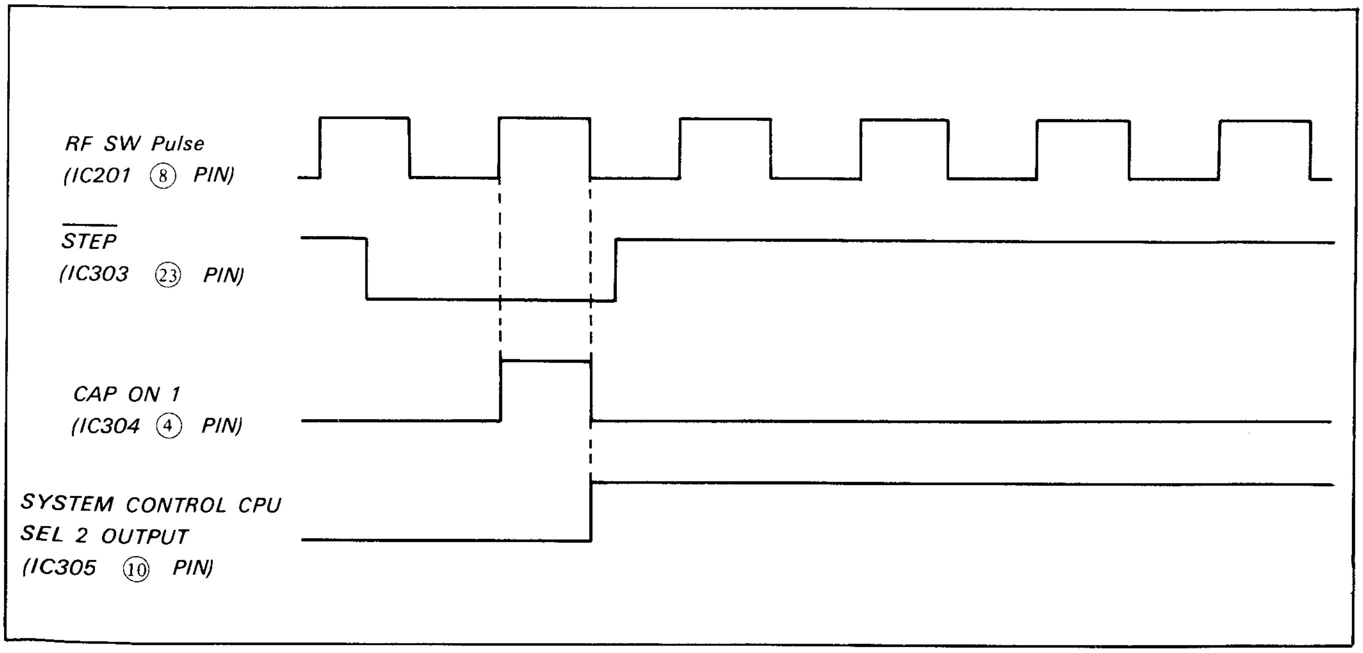


Fig. 3-32.

3-6-3. Capstan Intermittent Drive:

Due to azimuth relationship, only f_1 or f_3 field can stop in the STILL mode. In STEP or SLOW mode, it drives the capstan intermittently, feeding the tape frame-by-frame.
The capstan motor drive, brake and stop are carried out by two signals, i.e. CAP DRIVE and CAP RVS from the servo control CPU, so that the frame feeding is conducted.
The CAP ON and CAP CW/$\overline{\text{CCW}}$ signals are switched to the system control CPU mode or the servo control CPU mode by the $\overline{\text{SPAUSE}}$ signal. (Fig. 3-35. Table 3-3).

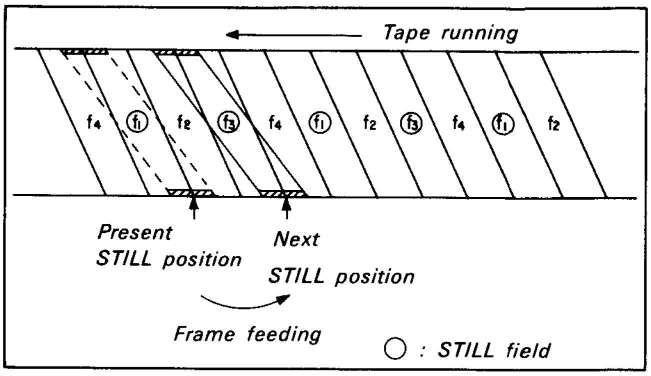


Fig. 3-33.

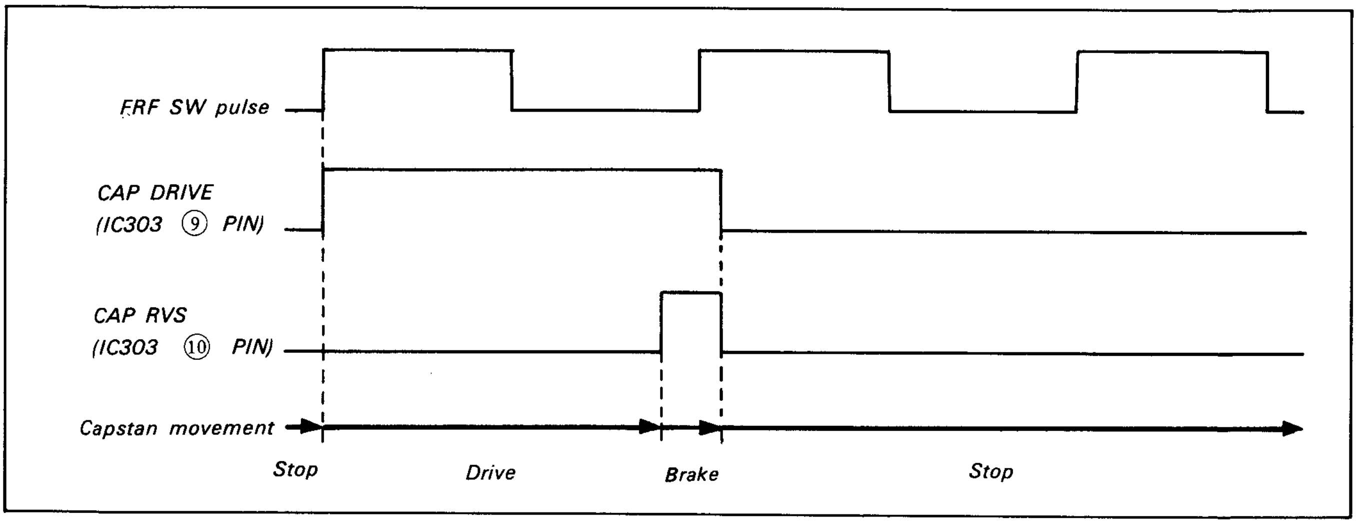


Fig. 3-34.

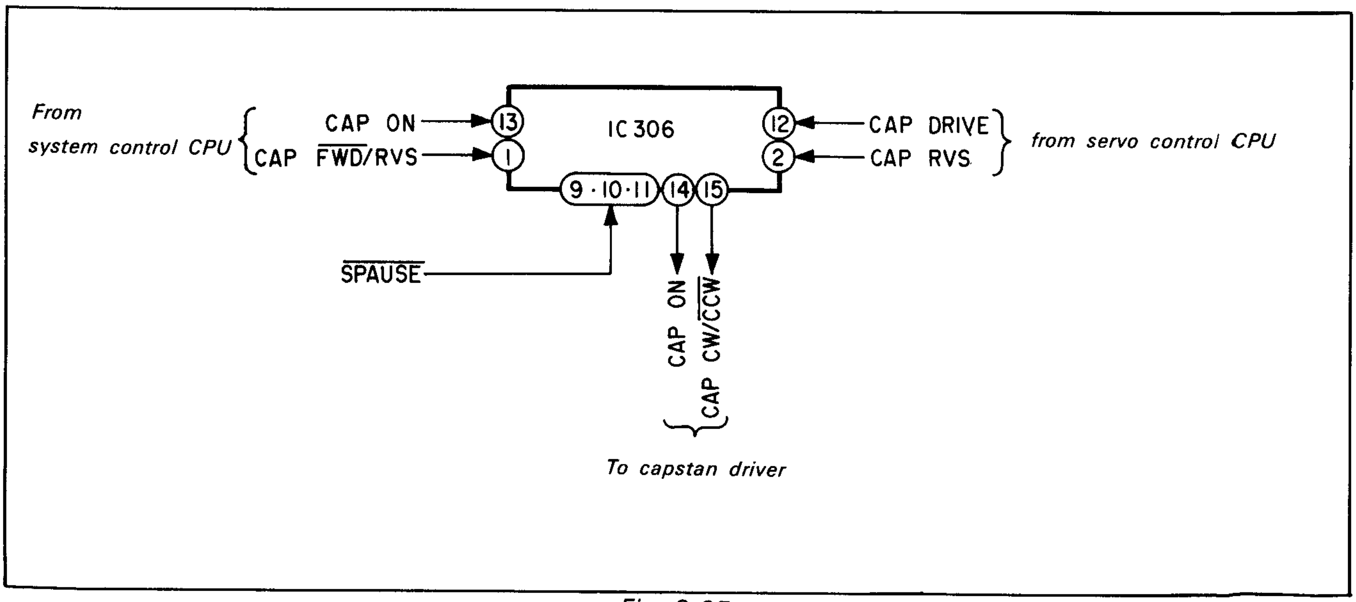


Fig. 3-35.

[Control switching]

$\overline{\text{SPAUSE}}$	CAP ON (IC306 ⑭) CAP CW/$\overline{\text{CCW}}$ (IC306 ⑮) output
H	System control CPU mode
L	Servo control CPU mode

Table 3-3.

[SP/LP mode CAP DRIVE, CAP RVS pulse duration]

	CAP DRIVE	CAP RVS
SP	43.0 msec	4.0 msec
LP	41.0 msec	2.4 msec

Table 3-4.

[Capstan, drum starter circuit]

In the case of carrying out the capstan intermittent drive, to ensure the lead from STILL state to the tracking PB state briefly, CAP FG signal should be input into pin ④ of IC402 and "H" level should be attained by passing the capstan error signal through D309 until FG signal is transmitted at the frequency which is determined by the C402, R410 time constant.

Likewise, in the case of drum RPM rising from STOP, the drum error signal is set to "H" level through D310 until drum FG signal is transmitted at the frequency determined by C401 R409 time constant. In both cases, if the FG signal exceeds the set frequency level, the current is turned off and the error signal line is separated.

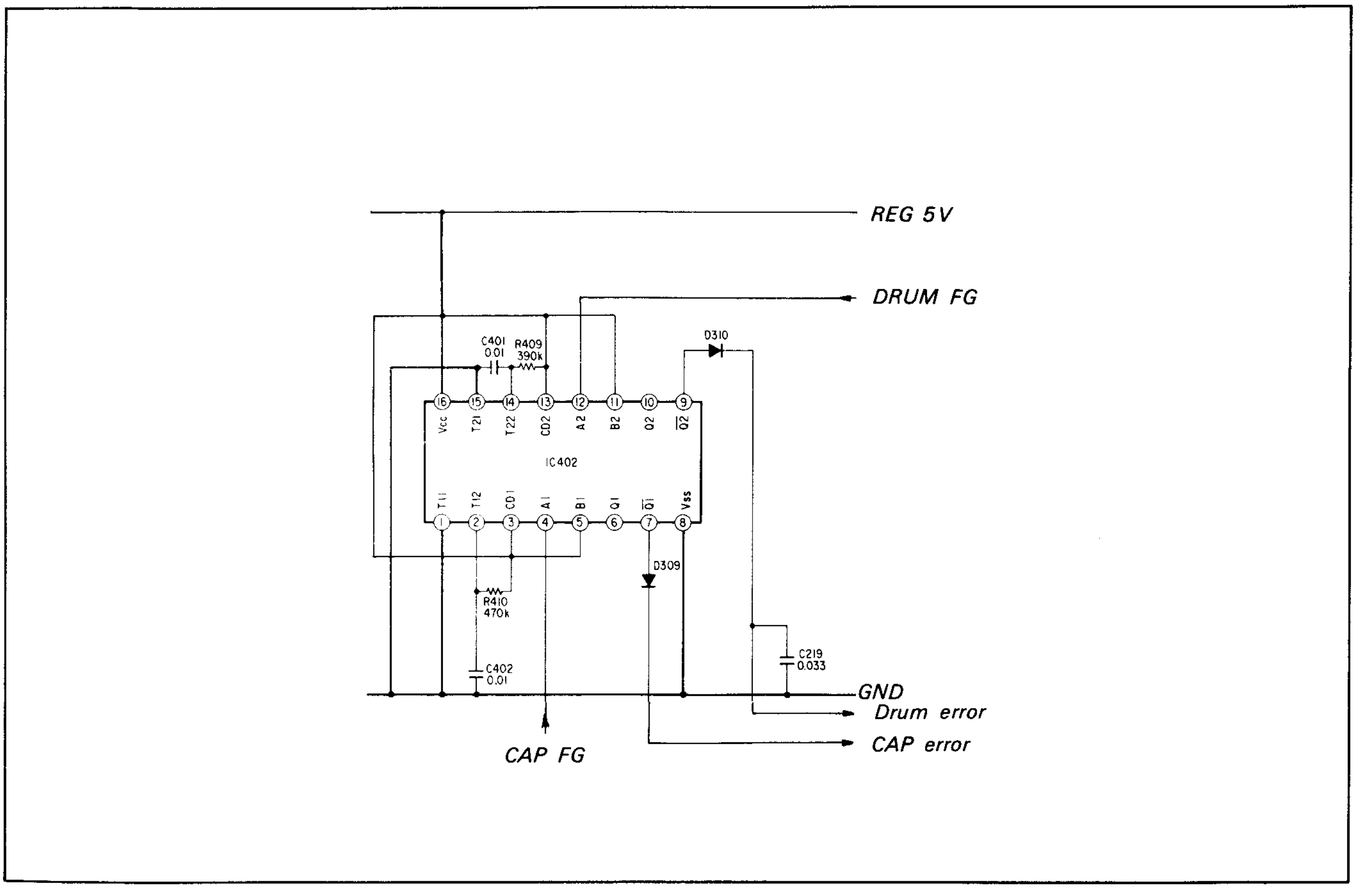


Fig. 3-36.

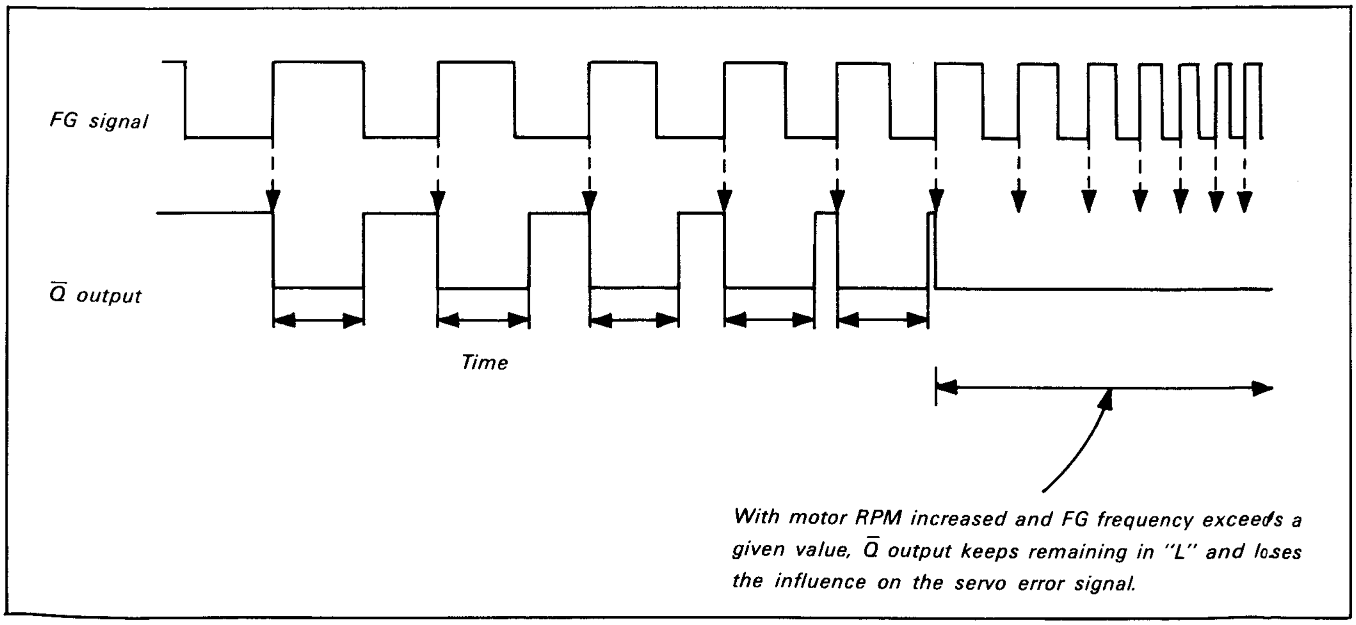


Fig. 3-37.

[ATF gain switch circuit]

If $\overline{SAPUSE}$ stays in "L" (STILL, STEP and SLOW), the switch between Pins ③ and ④ of IC 404 is turned on, and the series resistance of R318 and R319 is added to R246 and the ATF error gain is increased. In the case of SP mode, the switch between pins ① and ② is turned on so that the variable speed stability may be attained by increasing the ATF servo gain.

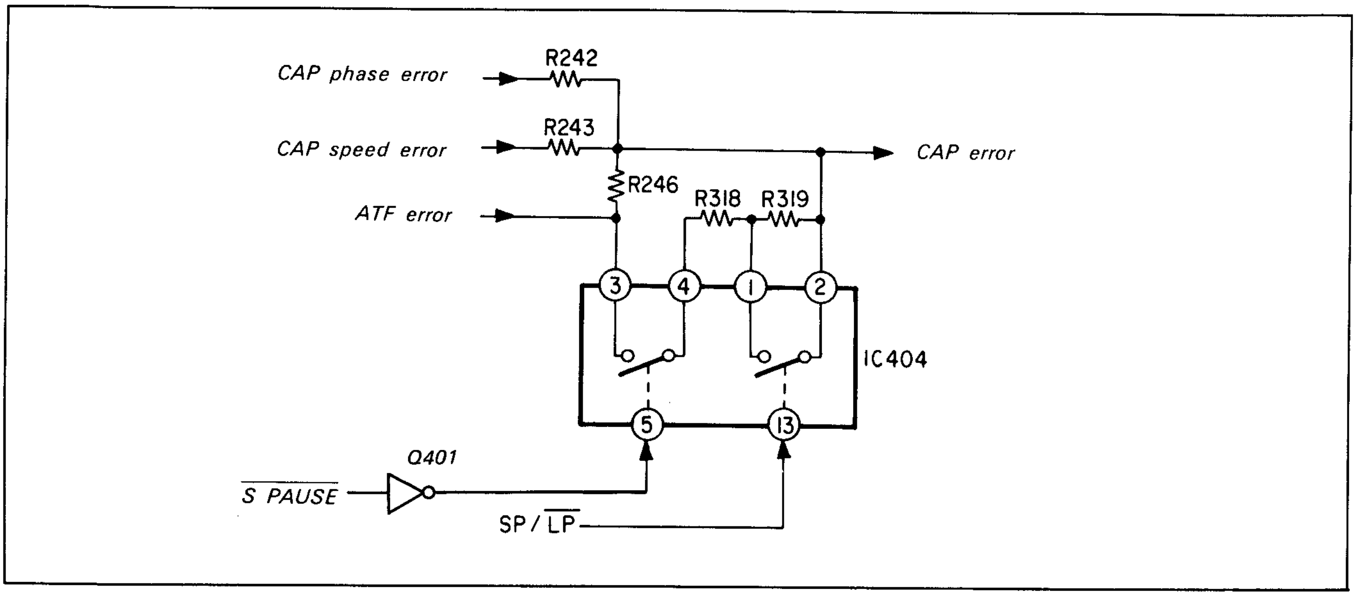


Fig. 3-38.

3-6-4. Chroma PS Switching and Double Azimuth Head Swtiching:

HCHG signal switches the double azimuth head (CH2, CH1') in the STILL- and STEP-playback mode for performing the field still playback. At the same time, VASWP switches the chroma signal PS (phase shift) process *1.

*1 Playback chroma signal phase is 90° shift per hour only in the case when playback is carried out by means of the CH1 head

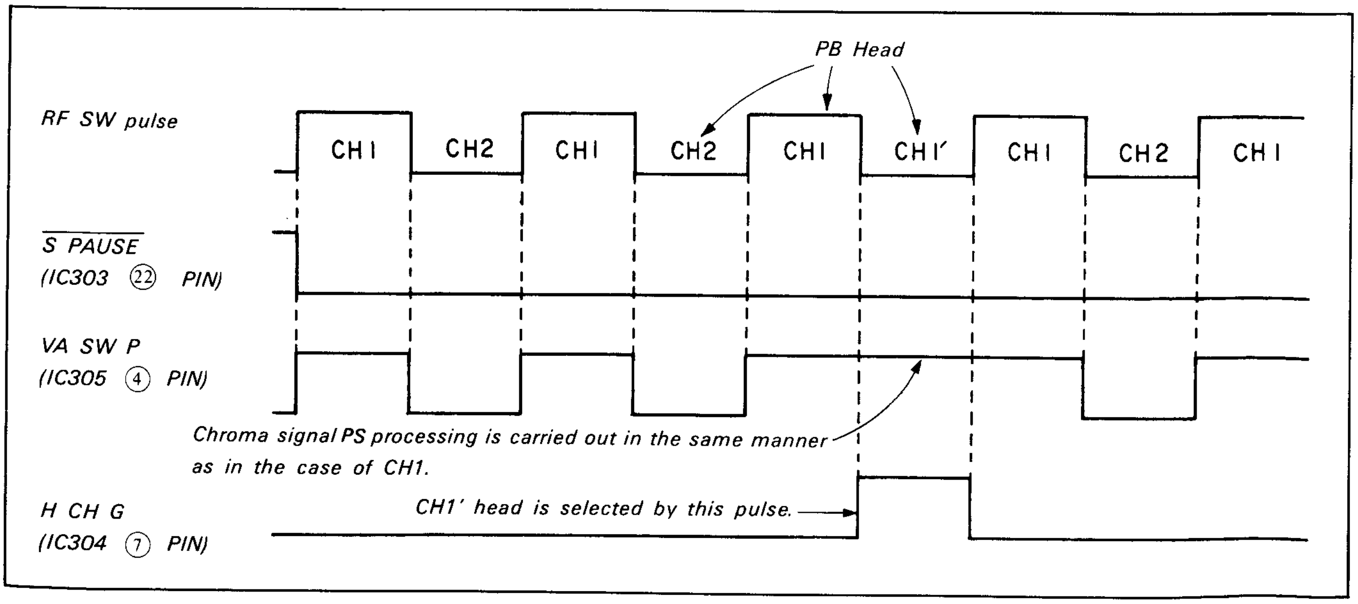


Fig. 3-39.

3-6-5. False VD Signal Processing Circuit

The false VD signal is produced by IC501 using the JOG VD signal from the digital servo (IC201: CX20135) as the timing pulse. The false VD signal pulse duration is determined by R503 and C502 to approx. 4H including the pulse range. Also, in the case of using the CH1' head in the STILL, STEP or SLOW modes, since the position of the VD signal separated from the playback video signal is different from that in the case of using CH1 or CH2 head, the false VD signal should be inserted earlier than normal only in the case of using the CH1' head. The time constant by which the insertion is determined (RV501, R502 and C301) caries with the HCHG signal input by D502, only in the case of using the CH1' head. Taking into consideration the possibility of V jitter arising from the TV phase characteristics, the TUNER PRESET is provided with a STILL ADJ adjusting knob (RV501). (See Fig.3-40.)

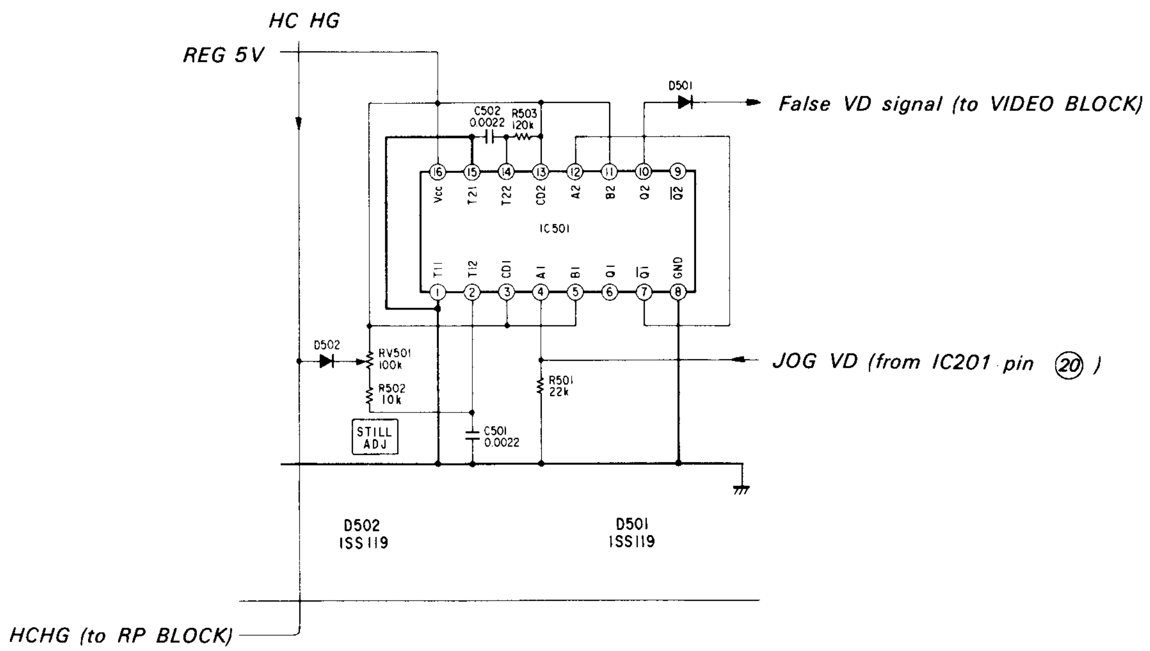


Fig. 3-40.

3-6-6. Correction of Slow f_H

The correction of drum speed in the STILL mode is carried out by means of the digital servo IC201. In the case of intermittent drive in STEP or SLOW modes, the horizontal frequency will be deviated. To correct the deviation, DCOMP signal from servo control CPU is mixed with CPA ON1 signal from IC304 by D411 and applied through R327 to the drum error as corrective voltage. (Fig.3-41 and 42).

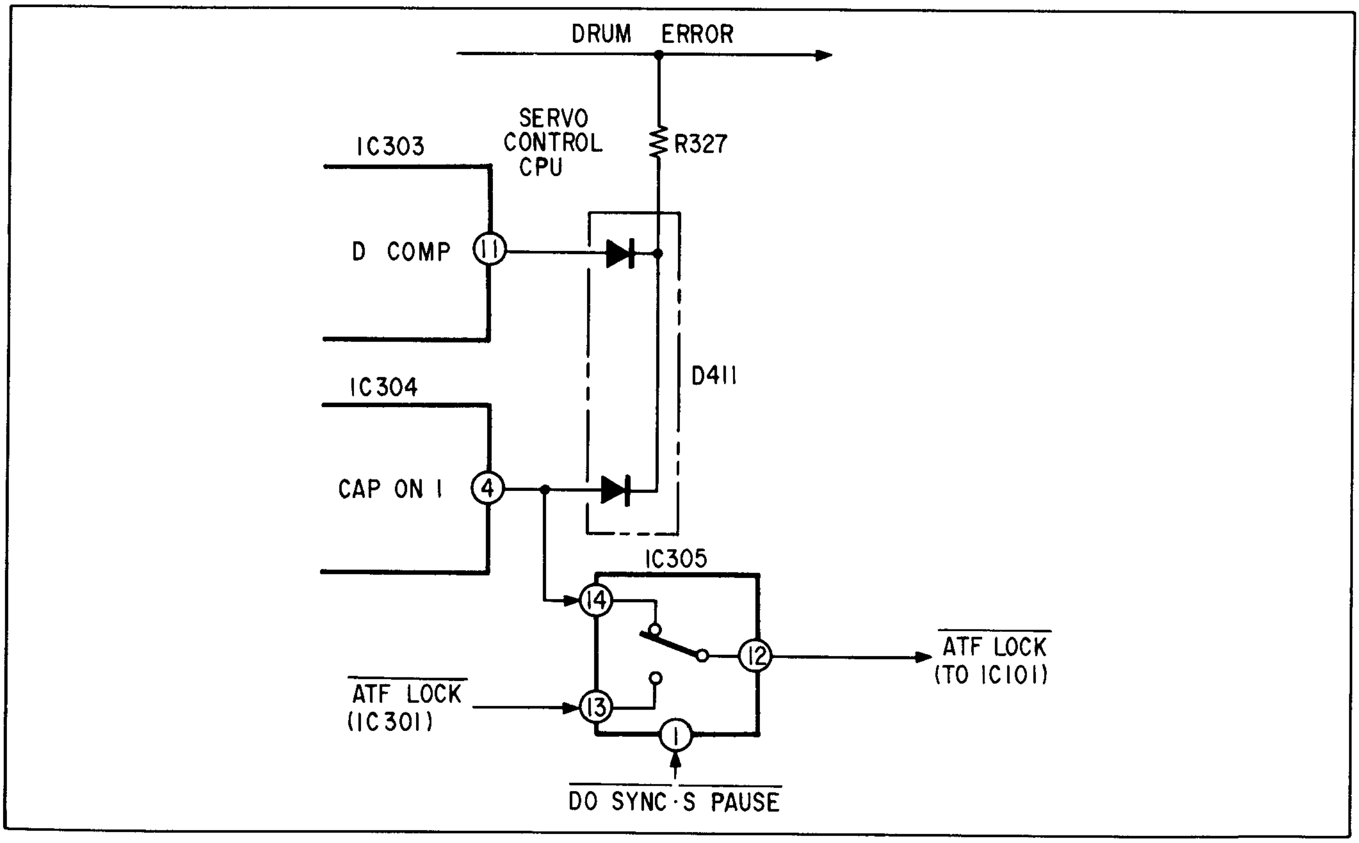
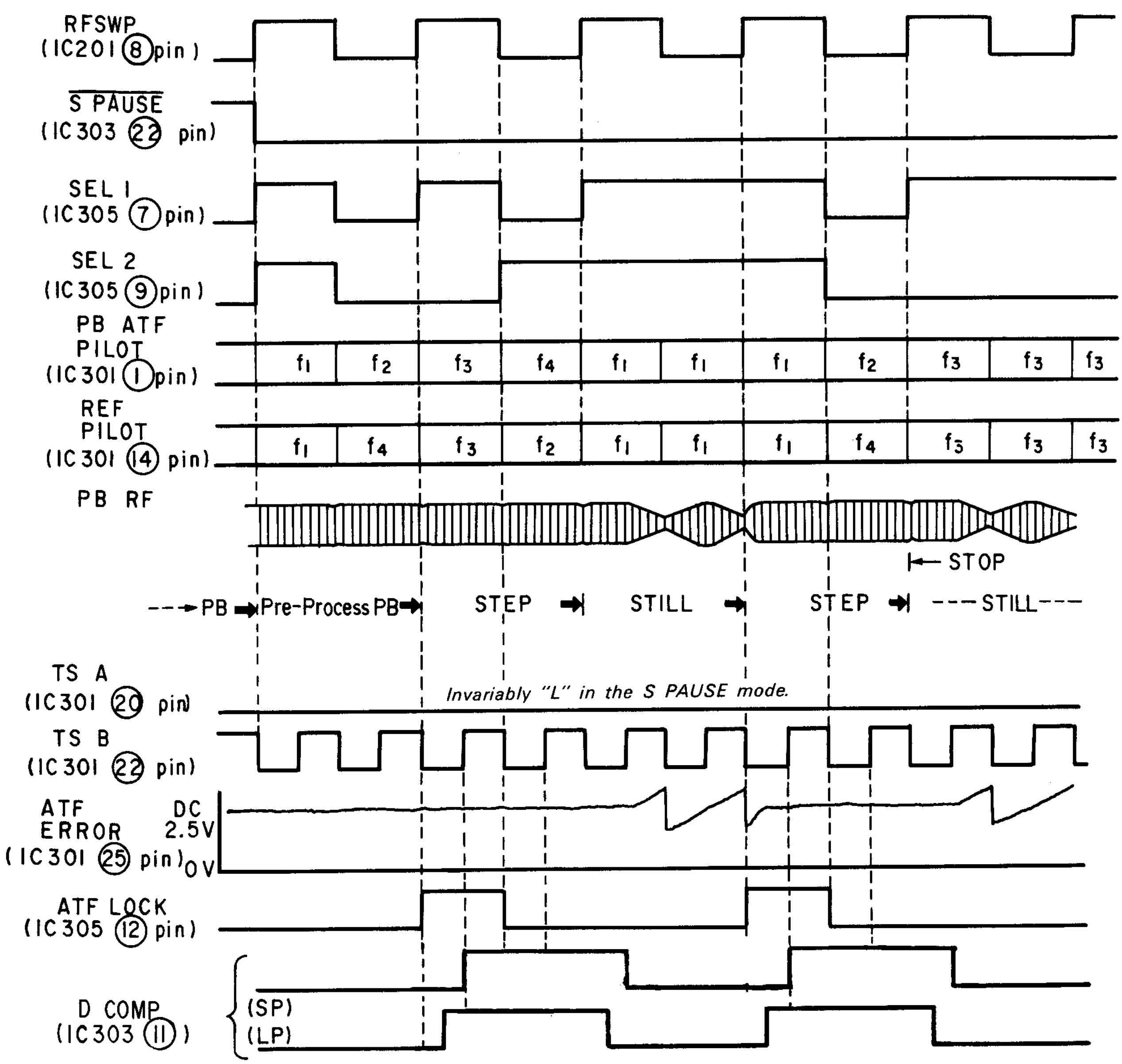


Fig. 3-41.



* ATF LOCK (IC305 pin 12) becomes equivalent to CAP ON 1 when $\overline{\text{SPAUSE}}$ = "L".

Fig. 3-42. PB→STILL Timing Chart

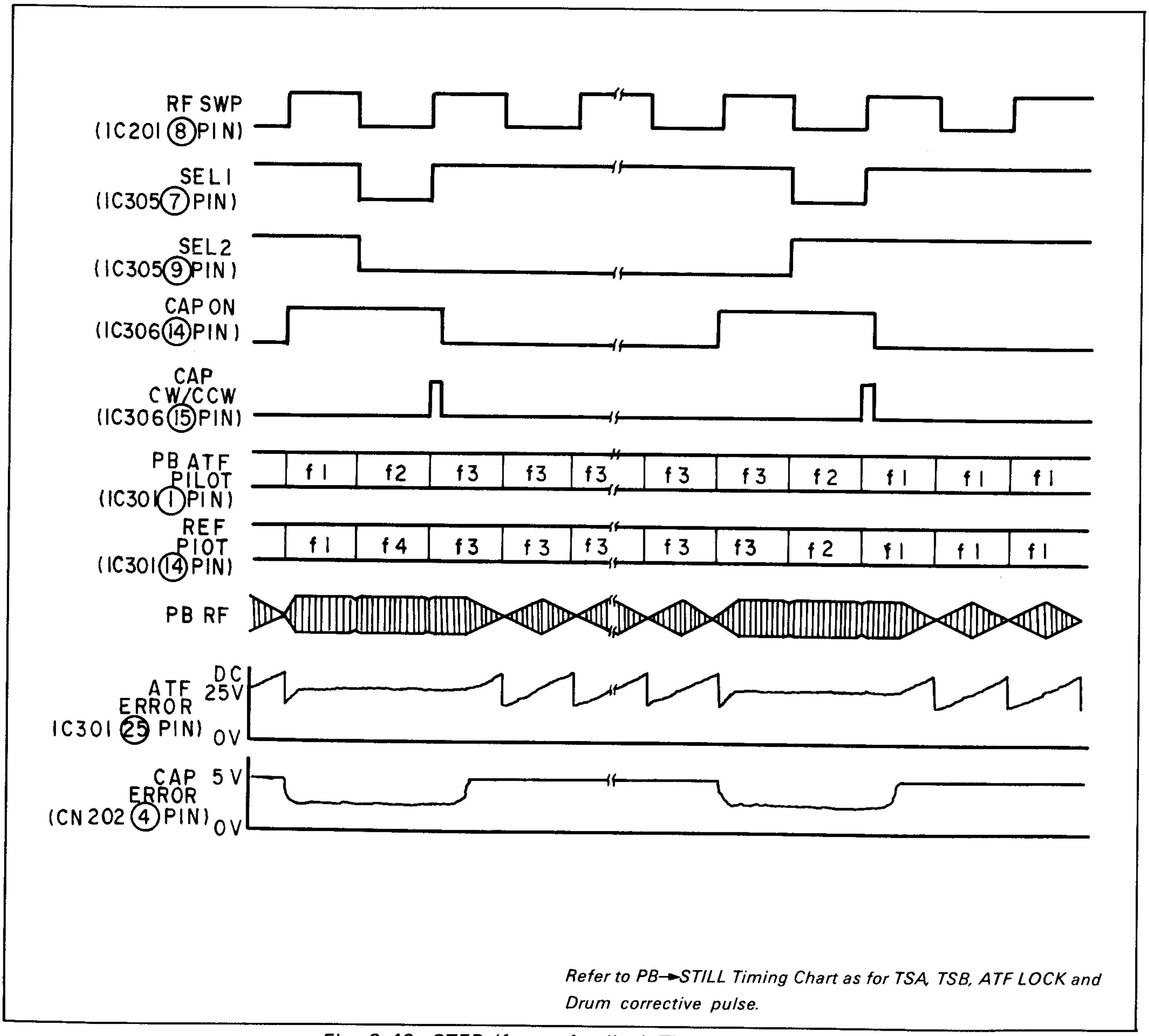


Fig. 3-43. STEP (frame feeding) Timing Chart

SECTION 4
SYSTEM CONTROL CIRCUIT

The system control circuit consists mainly of system control CPU (IC101) of SS-38F/G board.
The system control CPU is responsible for data transfer to the main timer CPU FT-3C/D board IC001), reception of commands, e.g., remote control, timer picture recording, etc., and transmission of display data, e.g., counter, channel, etc., as well as data transfer to Feature CPU (PC-15B board IC001) of PCM audio block and control on PCM audio block.
System control CPU is directly engaged in the following functions:

1 Reading of function key and tuning key.
2 Control of control motor
3 Control of loading motor
4 Control of capstan motor (ON/OFF only)
5 Control of drum motor (ON/OFF only)
6 Control of brake solenoid
7 Count of tape counter
8 Reading of tape top/end sensor
9 Tape speed identification
10 Tuner control
11 Control signal output to video block
12 Control signal output to audio block
13 Control of servo system

Emergency CPU (SS-38F/G board IC109) is responsible for the detection of abnormalties in the tape feeding system, and the servo CPU (SS-38F/G board IC303) auciliarily helps control the servo system in the course of variable speed playback, e.g., slow playback, picture search, etc.
The feature control CPU (PC-15B board IC001) provides the following functions:

1 Control of PCM audio system
2 Input/output of PCM ID signal
3 Residual tape detection

4-1. SYSTEM CONTROL CPU

The system control CPU (MB88551-159N) is a CMOS type 4-bit microcomputer which incorporates the 8192 words X 8 bits ROM and 256 words X 4 bits RAM, with the 80-pin flat package.

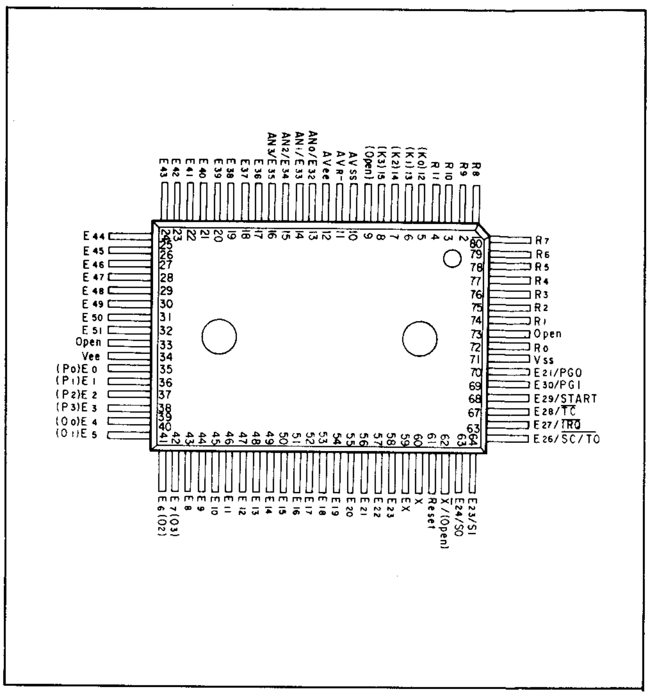


Fig. 4-1.

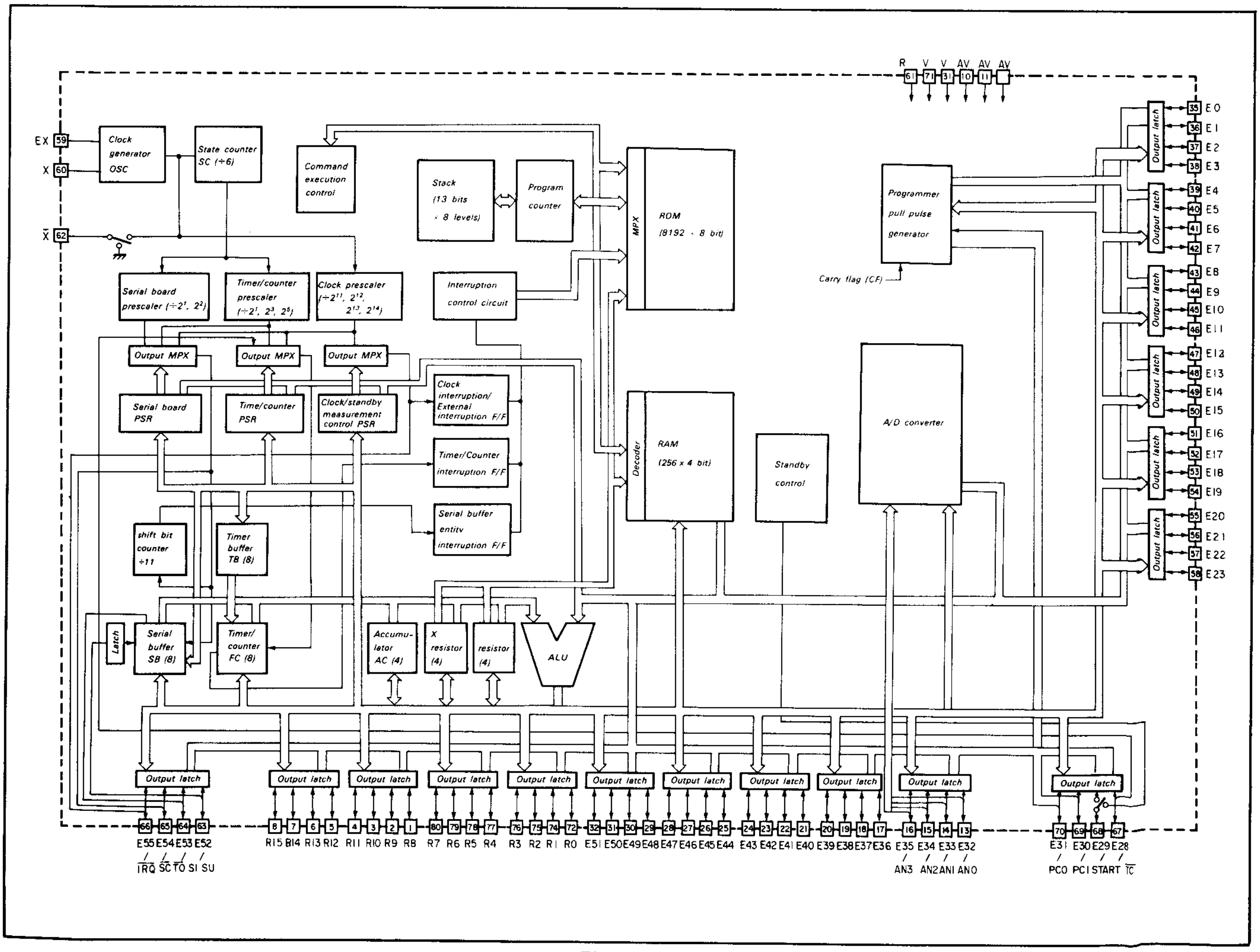


Fig. 4-2.

System Control CPU (SS-38F/G Board IC101) Pin Function

Pin No.	Signal	I/O	Function and Operaion	Connected to
1	AMUTE	O	Muted during tuner audio signal muting control output, preset search and channel switching.	TA-28A/29C board
2	REFP	O	Feature CPU output synchronization signal	PC-15B board feature CPU (IC001)
3	$\overline{\text{ATFLOCK}}$	I	Input signal of whether or not ATF tracking is ensured during playback	IC301 or IC304 through IC305
4	$\overline{\text{SPAUSE}}$	O	Capstan error signal control	
5	DD0	O	Capstan FG division data. DD3 is turned to MSB	
6	DD1	O		
7	DD2	O		
8	DD3	O		
9	NC			
10	AVss	I	GND	
11	AVR (−)	I		
12	AVcc	I	5V power supply	
13	LOAD	I	Analog voltage indicating the loading motor position	Loading switch through IC101 of MD-8D board
14	MODE	I	Analog voltage indicating the control motor position	Mode switch through IC101 of MD-8D board
15	FUNCTION	I	Analog voltage of function keys except REW and PAUSE	Function key of FU-33A board
16	PRESET	I	Analog voltage of channel selecting preset key	
17	Y0	I	TOP/REC PROOF. Tape top sensor input. Error erasure preventive switch input.	Tape top sensor or error erasure preventive switch through IC108
18	Y1	I	END/$\overline{\text{CDOWN}}$. Tape-end sensor input. Cassette down switch input.	Tape end sensor or cassette down switch through IC108
19	Y2	I	System control CPU serial data transfer request and PAUSE key input from RQTMTS/$\overline{\text{PAUSE}}$ main timer CPU.	Main timer CPU or Pause key through IC108
20	YSEL	O	Y0,1 and 2 input swiching output	IC108
21	CONTCW	O	Control motor control output	Control motor through IC103
22	CONTCCW	O		
23	LOADCW	O	Loading motor control output	Loading motor through IC104.
24	LOADCCW	O		
25	$\overline{\text{START}}$	O	Brake plunger control output	
26	$\overline{\text{HOLD}}$	O		
27	$\overline{\text{CS}}$	O	Digital servo IC chip select	IC201
28	SRESET	O	Digital servo IC and ATF IC reset output	IC201, and IC005 of VI-9A board
29	$\overline{\text{STEP10}}$	O	Not in use	
30	TFG2	I	Takeup side reel FG input.	
31	ABSTOP	I	Emergency stop input from Emergency CPU	Pin 7 of IC109
32	TFG1	I	Takeup side reel FG input. Counter value is calculated by TFG 1 and 2	

Table 4-1 (1)

Pin No.	Signal	I/O	Function and Operaion	Connected to
33	NC			
34	Vcc	I	5V power supply	
35	CAP ON	O	Capstan drive signal	IC001 of MD-8D board through IC306
36	CAP $\overline{\text{FWD}}$/RVS	O	Capstan rotation direction nomination	IC001 of MD-8D board through IC306
37	DRM ON	O	Drum drive signal	IC002 of MD-8D board
38	SP/$\overline{\text{LP}}$	O	SP/LP switching output	
39	TSB	O	$\overline{\text{ATFLOCK}}$ signal time sharing output	IC301
40	TSA	O	ATF error signal time sharing output	IC301
41	SEL1	O	ATF REF pilot code output	IC005 of VI-9A board through IC305
42	SEL2	O		
43	VIDEO MUTE	O	Video signal output muting output	IC005 of VI-9A board through IC111
44	JOG	O	Variable speed playback control output	IC303
45	VIDEO PB	O	Video block playback mode switching output	VI-9A board
46	AF REC	O	audio dubbing control output	PC-15B board and PR-25D board
47	$\overline{\text{FEON}}$	O	Flying erase head control output	PC-15B board
48	RP PB MODE	O	RP amplifier playback/recording switching signal	RP-25D board, etc.
49	VIDEO REC	O	Video block recording mode switching output	RP-25D board
50	TRAP	O	Not in use	
51	LATCH	O	Not in use	
52	REC MUTE	O	AFM record mute control output	PC-14B board
53	LINE MUTE	O	LINE output muting	PC-14B board and IC303
54	$\overline{\text{AUDIO PB}}$	O	AFM playback switching output	PC-14B board
55	BAND2	O	Tuner band switching	TA-28A/29C board
56	BAND1	O		
57	RQTSF	O	Transfer request signal of serial data to feature CPU	PC-15B board feature CPU (IC001)
58	RQTSMT	O	Transfer request signal of serial data to main timer	FT-3C/D board main timer CPU (IC001)
59	EX	I	System clock (6 MHz)	
60	X	O		
61	$\overline{\text{RESET}}$	I	Reset input	FT-3C/D main timer CPU (IC001)
62	NC			
63	SO	O	Serial data transfer output data	
64	SI	I	Serial data transfer input data	
65	$\overline{\text{SCK}}$	I/O	Serial data transfer serial clock	
66	$\overline{\text{IRQ}}$	I	ATF, tape top/end interruption input	
67	CAPFG 32	I	Input signal whereby capstan FG is 32-divided. Used as a tape feed count in continuous recording process.	
68	$\overline{\text{REW}}$	I	REW key input signal	
69	RFSP	I	RF SW PULSE input signal. ATF reference signal.	IC152 of PC-15B board

Table 4-1 (2)

Pin No.	Signal	I/O	Function and Operaion	Connected to
70	$\overline{\text{HDET}}$	I	Channel selecting just tune input	TA-28A/29C board
71	Vss			
72	UP	I	Channel selecting just tune input	TA-28/29C board
73	NC			
74	DOWN	I		
75	MACK	I	Acknowledge signal of serial data transfer with Feature CPU	PC-15B board feature CPU (IC001)
76	CLK	O	Non-volatile memoty control	Pin ⑥ of IC102
77	C1	O		Pin ⑦ of IC102
78	C2	O		Pin ⑧ of IC102
79	C3	O		Pin ⑨ of IC102
80	I/O	I/O		Pin ⑫ of IC102

Table 4-1 (3)

4-2. EMERGENCY CPU (SS-38F/G BOARD IC109)

Emergency CPU (M50761−692P) is a CMOS type 4-bit microcomputer, incorporating 512 words X 8 bits ROM and 32 words X 4 bits RAM, with 20-pin DIP package.

Pin connection diagram (Upper surface)

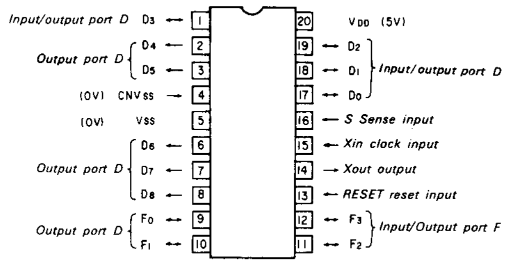


Fig. 4-3.

Emergency CPU (SS-38F/G BOARD IC109)

Pin No.	Signal	I/O	Function and operation	Connected to
1	16/$\overline{32}$	I	Input for SWITCHING CAP FG OUT (⑧ pin) output to divide CAP FG (⑯ pin) input to either in 16 or in 32.	GND
2	NC			
3	ATFECT	O	Step operation timing output	
4	CN Vss	I	GND	
5	Vss	I		
6	SEL2 OT	O	SEL 2 output during pause	
7	ABSTOP	O	Reel rotation detecting output. Emergency stop output at "H". "H": when the reel fails to turn over the following periods: REC/PB/FF/REW/CUE/REV mode 5 sec. SLOW mode 25 sec	System control CPU (IC101)
8	CAP FG32	O	Output to divide CAPFG at the dividing rate designated by 16/$\overline{32}$ (Pin①). In practice, 32 divided.	System control CPU (IC101)
9	CAP ON	I	Indication of reel turn detection interval.	System control CPU (IC101)
10	$\overline{\text{SPAUSE}}$	I	Reel turn detection mode and SEL20T output timing input	System control CPU (IC101)
11	SFG	I	Reel FG on S and T sides of reel turn signal	
12	TFG1	I		
13	$\overline{\text{RES}}$	I	Reset input	FT-3C/D board main timer CPU (IC001)
14	X OUT	O	System clock input/output (400 kHz)	
15	X IN	I		
16	CAPFG	I	FG input of capstan to be divided	IC202
17	SLOW	I	Reel turn detection mode input	PC-15B board feature CPU (IC001)
18	NC			
19	STEP1	I	SE 20T output timing input	5V power supply
20	VDD	I	5V power supply	

Table 4-2.

4-3. SERVO CPU (SS-38F/G BOARD IC303)

Servo CPU (M50763-633SP) is a CMOS type 4-bit micro-computer, incorporating 1K byte ROM and 48-word RAM, with 30-pin DIP package.

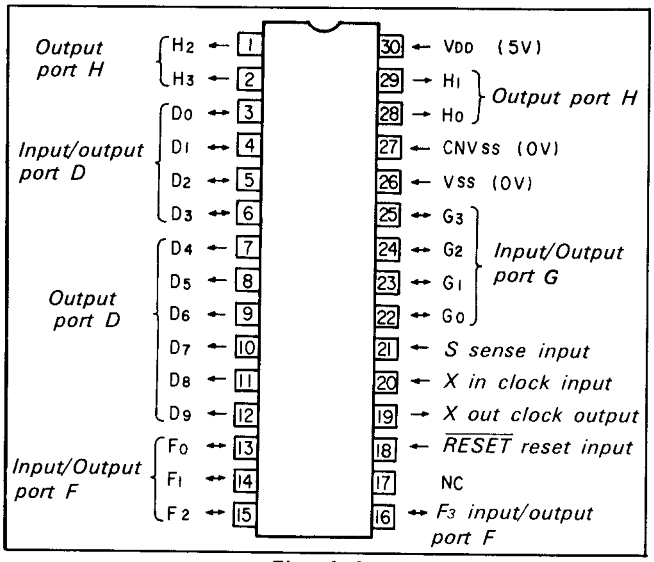


Fig. 4-4.

SERVO CPU (SS-38F/G board IC303)

Pin No.	Signal	I/O	Function and Operation	Connected to
1	$\overline{\text{R CONT}}$	O	Switching output in correction circuits in CUE and REV	Cue/Revlew velocity compensation circuit (Q201 to Q206, Q211 to Q215)
29	$\overline{\text{C CONT}}$	O		
28	C+R	O		IC204
4	SD2	I	CUE and REV mode input	System control CPU (IC101)
5	SD3	I		
3	LMUTE	I	Control input for the above corrections	
6	NTSC/$\overline{\text{CCIR}}$	I		GND

Input				Output			Remarks
NTSC/$\overline{\text{CCIR}}$	SD3	SD2	LMUTE	$\overline{\text{RCONT}}$	$\overline{\text{CCONT}}$	C+R	Mode
H	H	L	*	H	L	H	CUE
	L	H		L	H	H	REV
	Others			H	H	L	Others
L	H	L	H	L	L	H	CUE
	L	H		L	H	H	REV
	Others			H	H	L	Others
	*	*	L				

Pin No.	Signal	I/O	Function and Operation	Connected to
2	$\overline{\text{D0}}$ SYC	O	SD (Pin 13) RF SW PULSE rising/failing synchronization output.	
7	SOUT	O	Serial data to the outer shift resistor	Outer shift register (IC304)
8	SCK	O	Serial clock to the outer shift resistor	Outer shift register (IC304)
9	CAP DRIVE	O	PB PAUSE capstan drive signal	
10	CAP RVS	O	PB PAUSE capstan drive direction signal	
11	D COMP	O	PB PAUSE drum correction signal	
12	JOG OT	O	JOGIN (Pin 16) RF SW PULSE rising/failing synchronization output	
13	SDO	I	Capstan dividing rate LSB	System control CPU (IC101)
14	SLOW	I	SLOW mode input	
15	SP/$\overline{\text{LP}}$	I	PB PAUSE capstan drive and drum correction timing control output	System control CPU (IC101)
16	JOG IN	I	RF SW PULSE synchronization fails at JOG signal	System control CPU (IC101)
17	NC			

Table 4-3(1)

Pin No.	Signal	I/O	Function and Operaion	Connected to
18	$\overline{\text{RESET}}$	I	Reset input	FT-3C/D board main timer CPU
19	X OUT	O	Not in use	
20	X IN	I	SYSTEM CLOCK input	
21	RFEX	I	Input synchronized with RF SW PULSE	
22	$\overline{\text{SPAUSE}}$	I	PB PAUSE mode input	System control CPU (IC101)
23	$\overline{\text{STEP}}$	I	STEP operation input	
24	$\overline{\text{TXTIME}}$	I	Timing input signal of serial transfer with outer resistor	
25	RFSP	I	RF SW PULSE for synchronization	
26	Vss	I	GND	
27	CN Vss	I		
30	VDD	I	5V power supply	

Table 4-3 (2)

4-4. SERIAL DATA TRANSFER BETWEEN SYSTEM CONTROL CPU AND FEATURE CPU:

8-bit data transfer is carried out by means of the five following signal wires:
RQTSF, MACK, SFDATA, SI, $\overline{\text{SFCK}}$
Data transfer is carried out in one way to Feature CPU from the System Control CPU, in much the same manner as in the case of System Control CPU—Timer CPU data transfer.

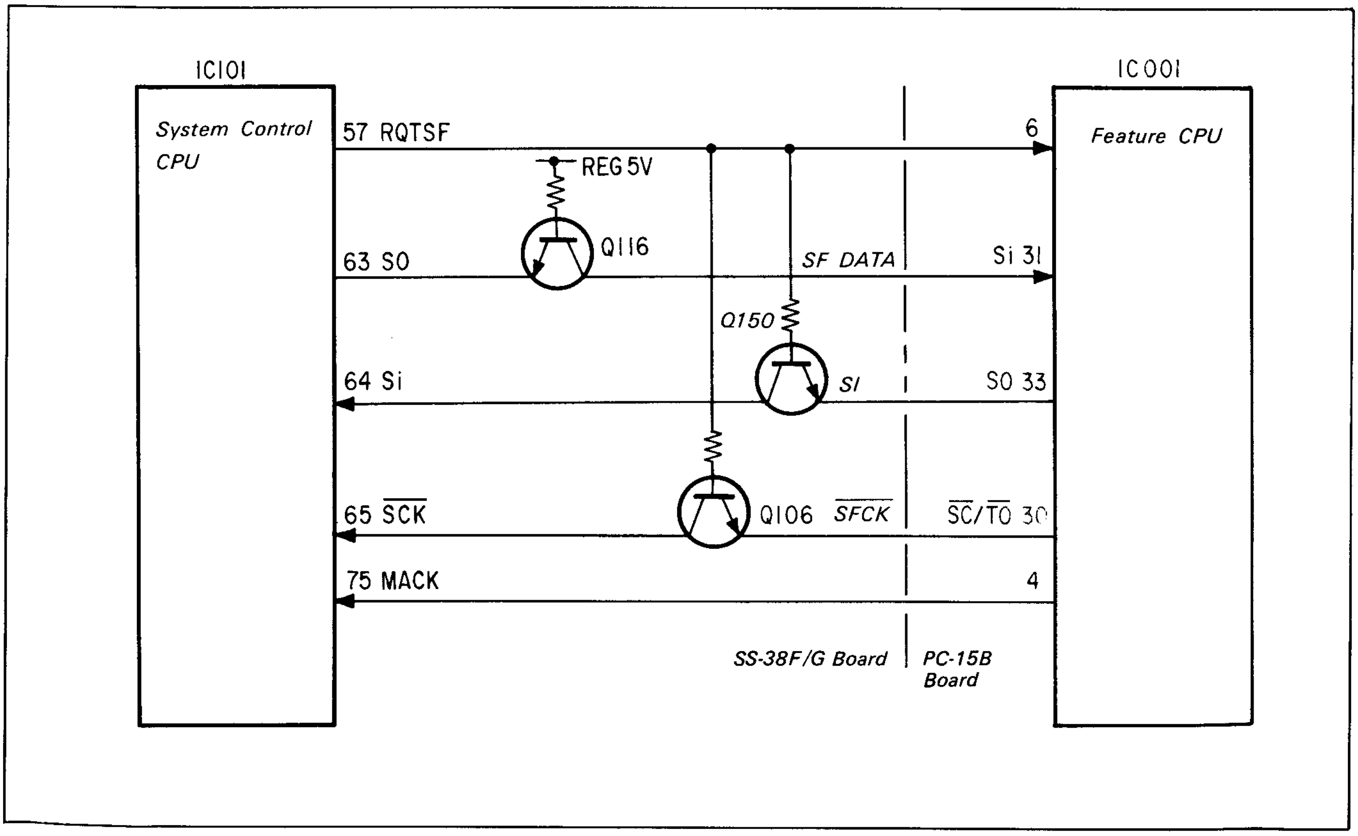


Fig. 4-5.

4-5. AFM MUTE CIRCUIT (SS-38F/G BOARD)

This circuit corrects the AFM audio signal muting timing by the use of $\overline{\text{A PB}}$ and V MUTE signals.
Output from Pin ⑩ of IC110 (TC4011BP) employs four logical outputs as shown in Table. 4-4.
(3) and (4) ensure the muting performance. "Hold" (3) means that, if V MUTE signal is raised when $\overline{\text{A PB}}$ signal is at "H", even if the $\overline{\text{A PB}}$ signal is turned to "L" thereafter, Pin ⑩ of IC110 is output with V MUTE signal, and that, if V MUTE signal is raised when $\overline{\text{A PB}}$ signal is at "L", waiting is required until $\overline{\text{A PB}}$ signal is turned to "H".
Fig. 4-7. shows the timing in practice.

Signal	V MUTE	$\overline{\text{A PB}}$	Pin ⑩ of IC110
(1)	L	L	L
(2)	L	H	L
(3)	H	L	Hold
(4)	H	H	H

Table. 4-4.

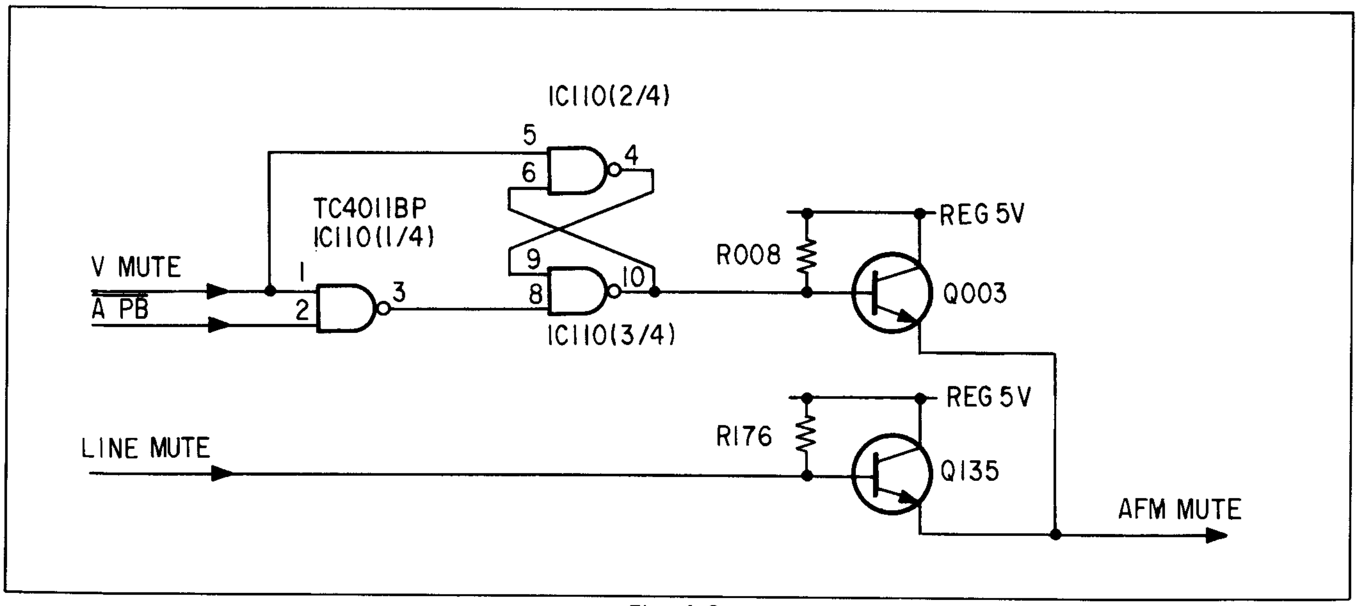


Fig. 4-6.

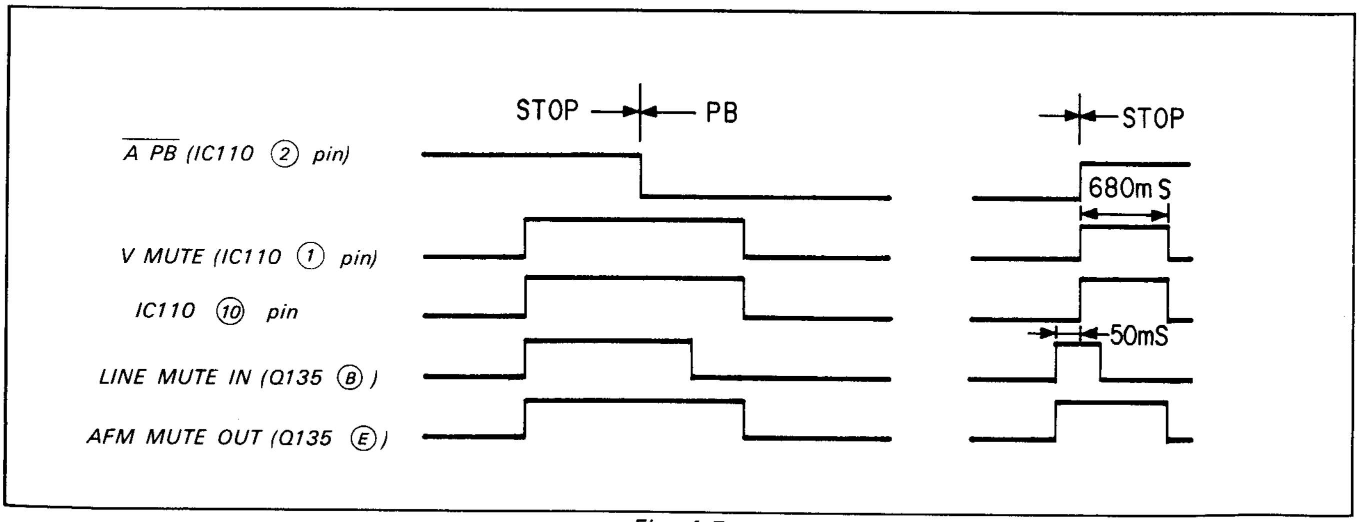


Fig. 4-7.

4-6. V MUTE CIRCUIT (SS-38F/G BOARD)

If the VIDEO PB signal is at "H", the V MUTE signal output (Pin ⑥ of IC111) whose pulse duration has been extended by IC111 and the V MUTE signal are added by D004 and D005 (2/2). However, since the output from Pin ⑥ of IC111 is prohibited by Q010 if the VIDEO PB signal is at "L", VIDEO MUTE output is turned to VIDEO MUTE input. It is because the pulse width is not extended when the V MUTE signal is output during EE channel switching. It is also because IC111 (2/2) and D005 (1/2) output V MUTE pulse at the falling of VIDEO PB signal.

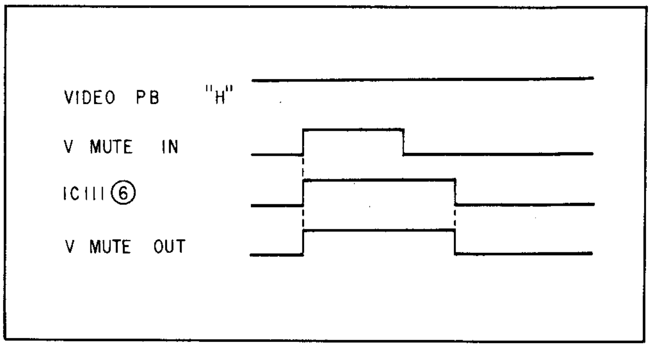


Fig. 4-8.

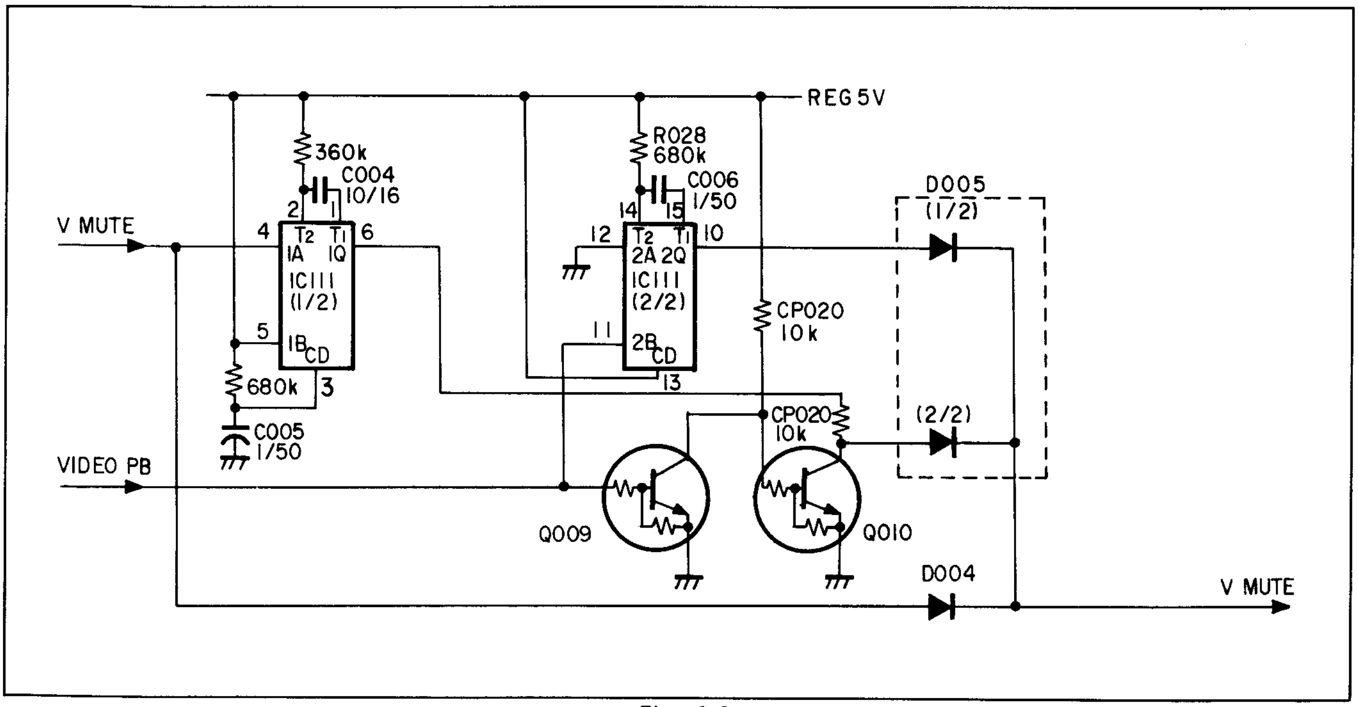


Fig. 4-9.

4-7. INTERRUPTION SIGNAL (SS-38F/G BOARD)

The system control CPU IC101 interruption input IRQ offers the three following functions by means of Pin (66) alone:

(1) Tape top interruption

(2) Tape end interruption.

(3) RFSWP rising/falling interruption.

The interruption (3) serves as a reference signal to generate the ATF reference pilot.

The positive logical OR of tape top signal and tape end signal is received by D102 and rising only is extracted by C115 so that it is converted into negative logical pulse by Q130.

Meanwhile, the delayed signal is input into Pin (5) and RFSWPULSE is input into Pin (6) of IC105, so that positive logical pulse is output from Pin (4) in the course of RF SW PULSE rising and falling and converted into negative logical pulse by Q122 and simultaneously Q130 output and OR are taken so that they are input into the microcomputer.

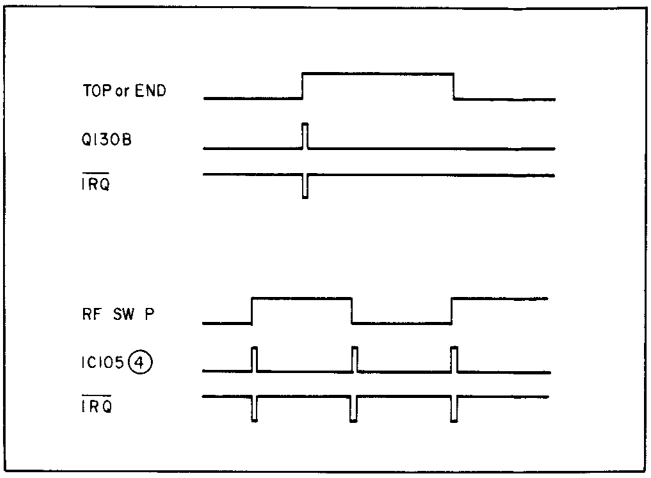


Fig. 4-10.

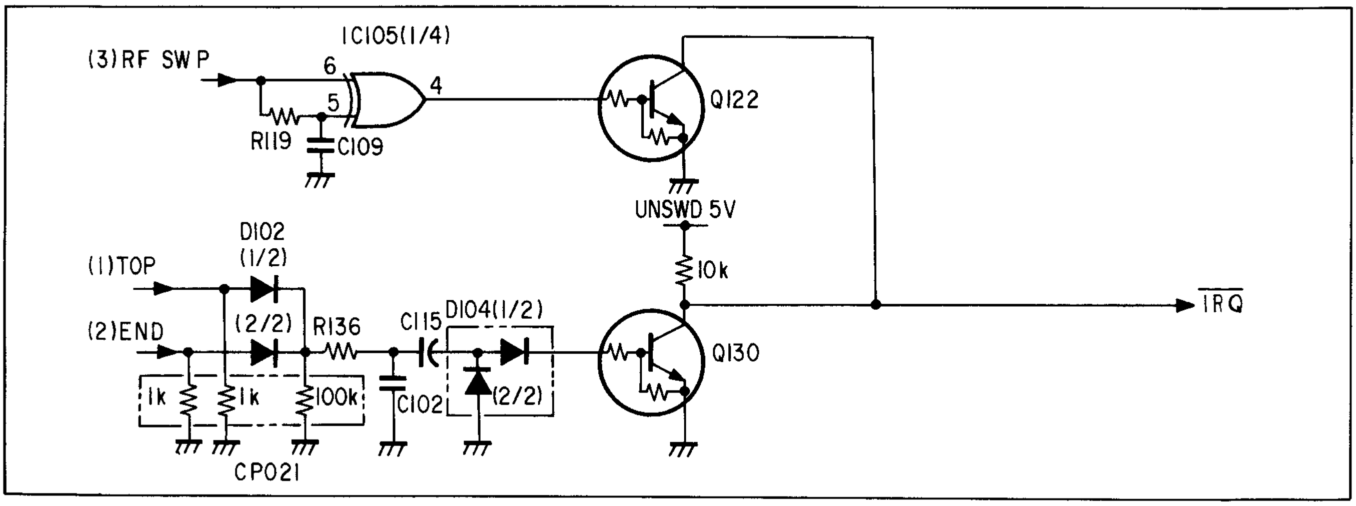


Fig. 4-11.

4-8. FE CONTROL (SS-38F/G BOARD)

The control signal ($\overline{\text{FEON}}$) of FE (Flying Erase) head is output from Pin (47) of the System Control CPU (IC101) in a negative logical pulse, and converted into normal/audio dubbing/multi corresponding signal through Shift CPU of Substrate PC-15B board, and returned to SS-38F/G board and output to RP-25D board in the form of an open corrector output created by Q131.

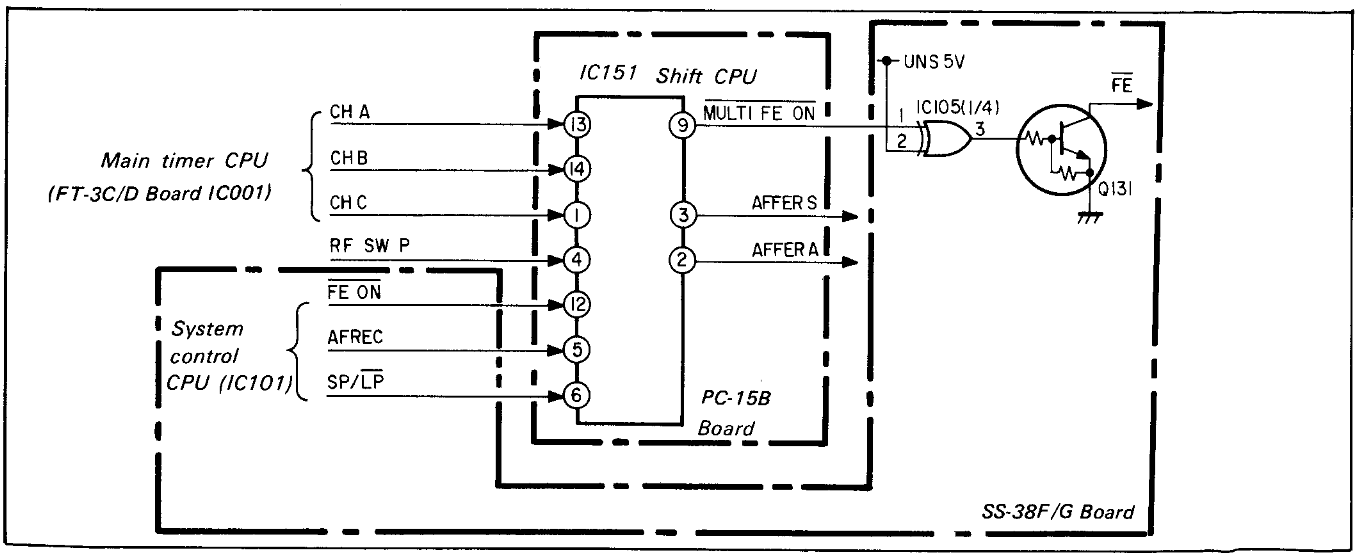


Fig. 4-12.

4-9. ANALOG INPUT CIRCUIT(SS-38F/G BOARD)

There are four types of analog inputs as follows:

1. Load Pin ⑬ of IC101
2. Mode Pin ⑭ of IC101
3. Function Pin ⑮ of IC101
4. PRESET Pin ⑯ of IC101

They are converted by the following circuit in such a way that LOAD and MODE inputs are made into one single analog voltage from the three digital signals and regarding FUNCTION and PRESET, into one signal analog voltage from a plurality of tact keys.

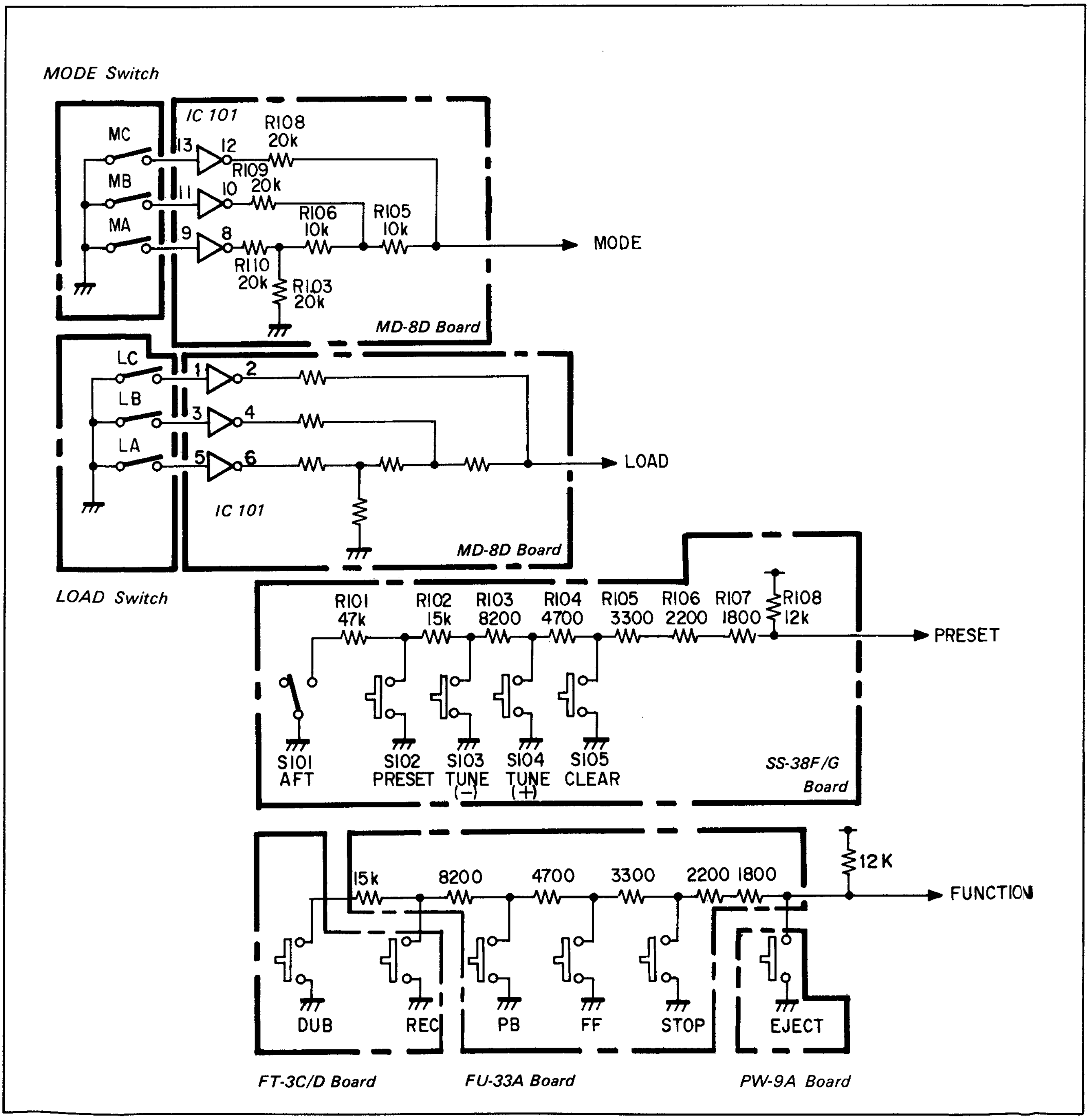


Fig. 4-13.

(1) Analog port voltage and position.

Data in micro-computer	Function key (FUNCTION)	Channelling preset key (PRESET)	CONTROL Motor position (MODE)	LOADING Motor position (LOAD)	Analog voltage value (V)
F	ALL OFF	ALL OFF			4.6875
E		AFF ON			4.375 center
D					4.0625
C	AUDIO DUB	PRESET ON	FWD	LOADING TOP	3.750 center
B					3.4375
A	REC	TUNING (−) ON	LOAD/UNLOAD		3.125 center
9					2.8125
8	PB	TUNING (+) ON	STOP	LOADING END	2.500 center
7					2.1875
6	FF	CLEAR	EJECT	DRUM START	1.875 center
5					1.5625
4	STOP		RVS	UNLOAD WAIT	1.250 center
3					0.9375
2			FF/REW	T REEL START	0.625 center
1					
0	ELECT		Other than above	Other than above	0.3125

Table. 4-5.

2. Control motor/loading motor position and direction:

(a) CONTROL MOTOR

	Position	Code C	Code B	Code A	Analog voltage (V)	Data in Micro-comoputer
(↶) CW	B0	1	1	1	0.0000	0
	ELECT	1	0	0	1.8750	5.6
	B1	1	1	1	0.0000	0
	LOAD/UNLOAD	0	1	0	3.1250	9.A
	B2	1	1	1	0.0000	0
	FF/REW	1	1	0	0.6250	1.2
	B3	1	1	1	0.0000	0
	STOP	0	1	1	2.5000	7.8
	B4	1	1	1	0.0000	0
	FWD	0	0	1	3.7500	B.C
	B5	1	1	1	0.0000	0
CCW	RVS	1	0	1	1.2500	3.4
(↷)	B6	1	1	1	0.0000	0

Table. 4-6.

* 1: OPEN
0: CLOSE

* B_0 to B_6: Position during mode changing.

(b) LOADING MOTOR

	Position	Code C	Code B	Code A	Analog voltage (V)	Data in Micro-comoputer
(↷) CCW	LOADING TOP	0	0	1	3.7500	B.C
	B1	1	1	1	0.0000	0
	UNLOAD WAIT	1	0	1	1.2500	3.4
	B2	1	1	1	0.0000	0
	DRUM START	1	0	0	1.8750	5.6
	B3	1	1	1	0.0000	0
	T REEL START	1	1	0	0.6250	1.2
	B4	1	1	1	0.0000	0
CW (↶)	LOADING END	0	1	1	2.5000	7.8

Table. 4-7.

* 1: OPEN
0: CLOSE

* B_1 to B_4: Position during mode changing.

4-10. INPUT SIGNAL EXTENSION (SS-38F/G BOARD)

Pins ⑰ to ⑲ are used for time division to extend the input port of the System Control CPU (MB88551) and have respectively two meanings. Pin ⑳ (Y SEL) is responsible for the output of the time division.

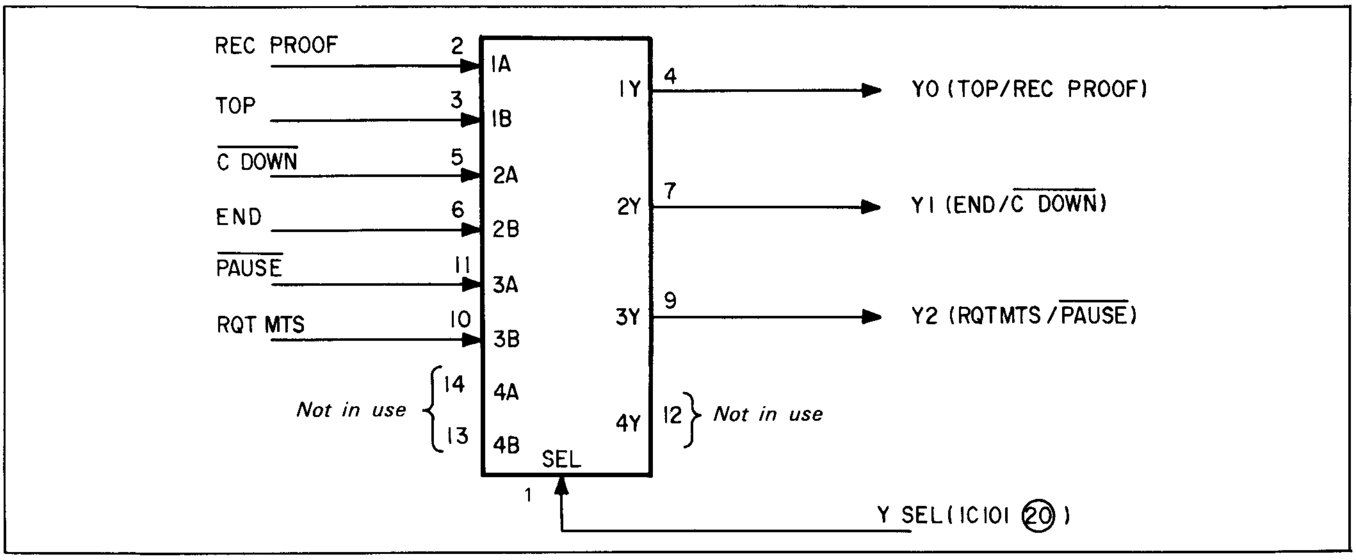


Fig. 4-14.

Input corresponding with Y SEL = H/L

	Y SEL="H"	Y SEL="L"
Y0 Pin ⑰ of IC101	TOP "H" at the tape top	REC PROOF "H" when the claw is broken
Y1 Pin ⑱ of IC101	END "H" at the tape end	CDOWN "L" at Cassette IN
Y2 Pin ⑲ of IC101	RQTMTS Request of transfer from timer CPU	PAUSE "L" at PAUSE Key ON

Table. 4-8.

4-11. RESET CIRCUIT (SS-38F/G BOARD)

1. Reset Circuit of Timer CPU (FT-3A board IC001, IC002)
(To FT-3A Board IC001, IC002)

When BACK UP15V rises, Pin ⑤ of IC107 instantaneously becomes D108 Zener Diode with 2.7V. Pin ⑥ becomes 0V only during C117 is being charged. As a result, "H" is output to Output pin ⑦. The output is fed back to input by C114 and Q114, to fix 0V of Pin ⑥ and stabilizes "H" output.

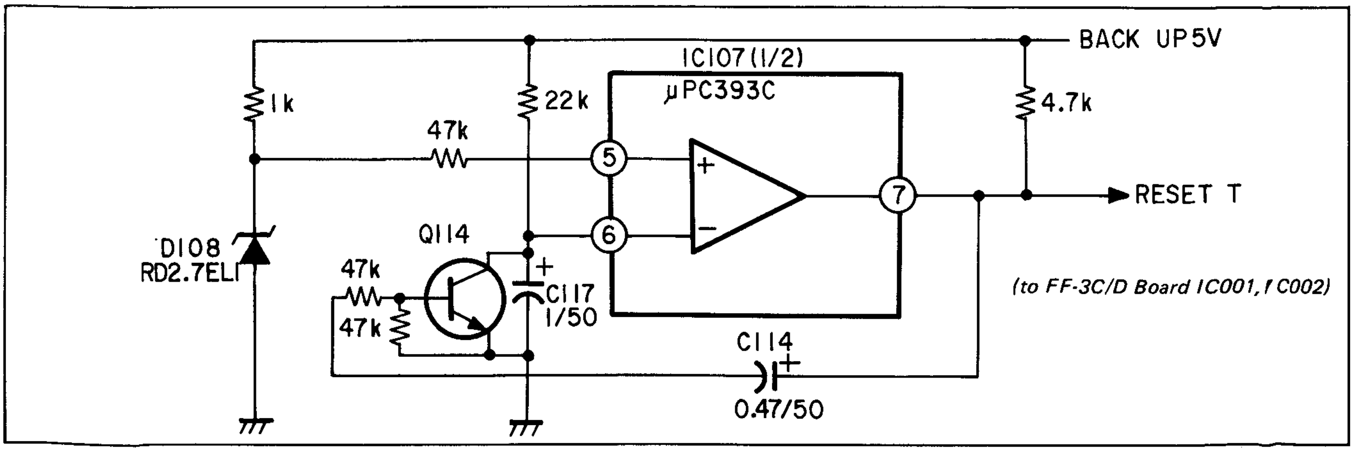


Fig. 4-15.

SECTION 5
TUNER CIRCUIT

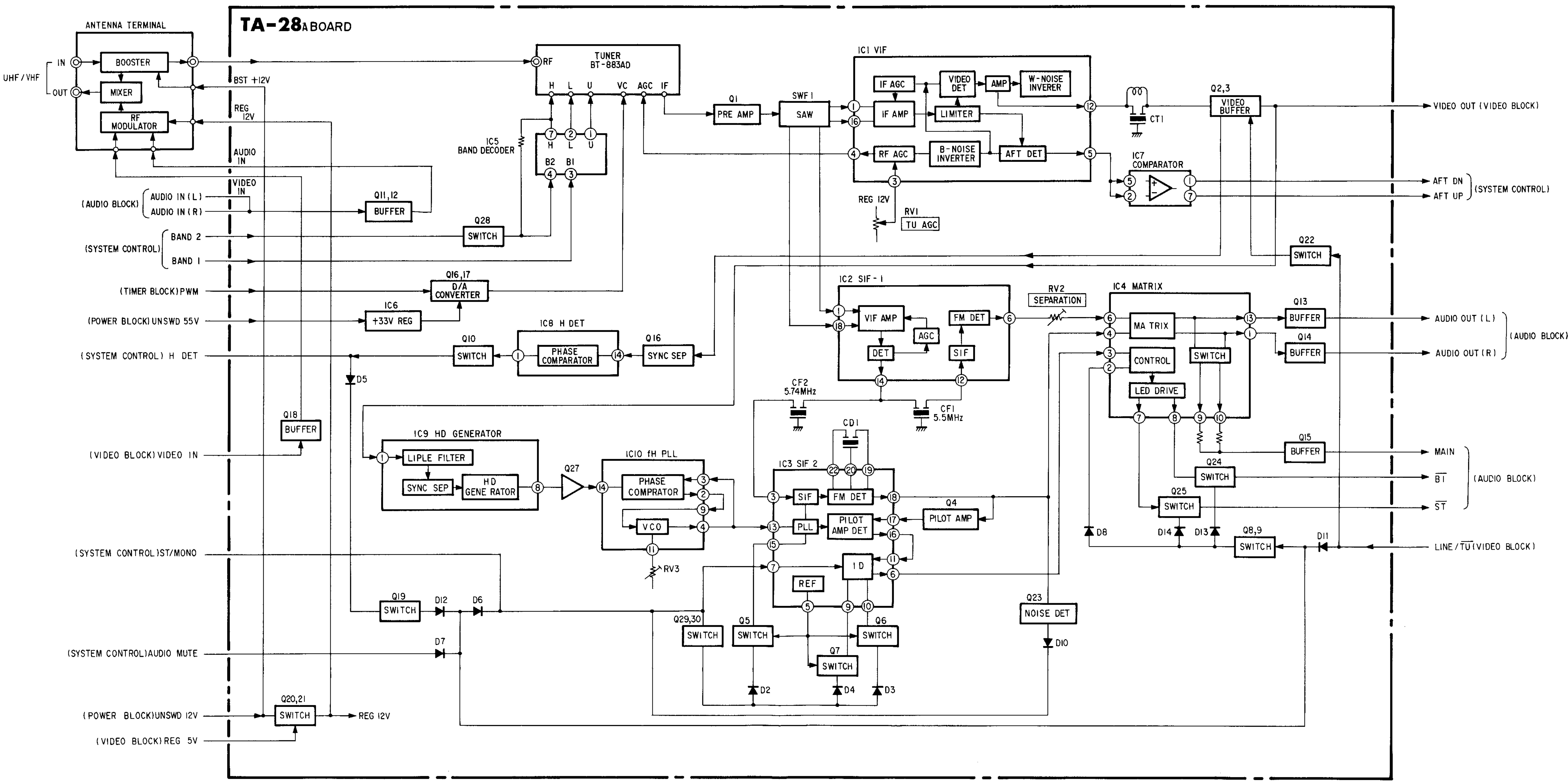


Fig. 5-1. Tuner Block Diagram (EV-S700ES)

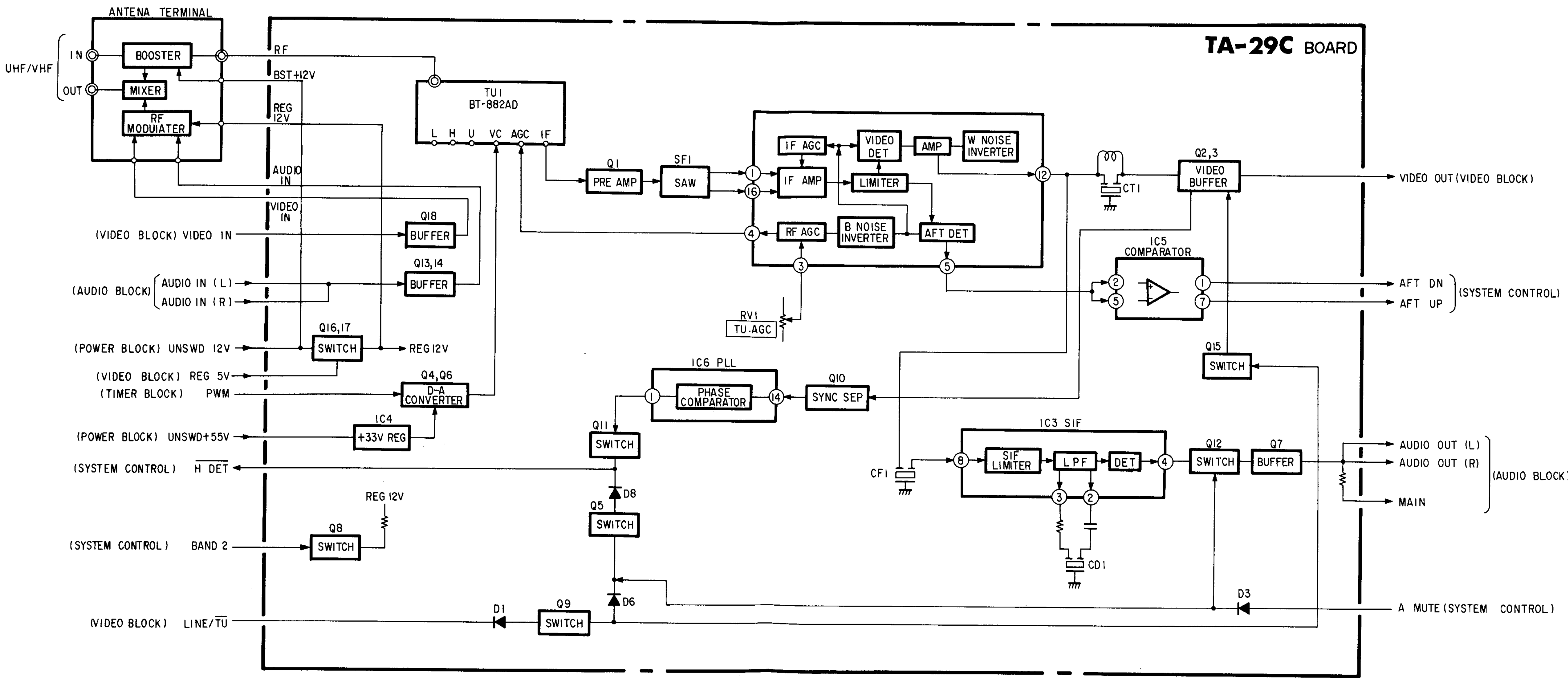


Fig. 5-2. Tuner Block Diagram (EV-S700UB)

5-1. SIGNAL SYSTEM (EV-S700ES)

1. TUNER

The broadcast signals input from the AERIAL IN terminal are amplified approximately 4 dB by the RFU (RF modulator, booster, and mixer) and are input to the RF input terminal of the tuner (sensitivity select switch: DX position).
The bloadcast signals are output from the IF output terminal after being tuned, amplified, and frequency converted by the tuner. Each of the signals has three frequency components, namely, 38.9 MHz as a picture carrier (f_P), 33.4 MHz as a sound carrier (f_{S1}), and 33.158 MHz as other sound carrier (f_{S2}: only when receiving sound multiplex broadcast).

2. VIF

The signals are amplified by a preamplifier comprising Q1, L1 and L2 and are spectrum shaped by a surface acoustic wave filter (SAWF) SWF 1.
Each signal is divided here into two parts. One is a picture signal and is input to pins ① and ⑯ of IC1. The other is a sound signal and is input to pins ① and ⑱ of IC2.
The signal input to pins ① and ⑯ of IC1 is after amplified by the VIF AMP and is output from pin ⑫ of IC1 as a video signal after being SYNC detected. The video signal is output to the video circuit through the voice trap CT1 (5.5 MHz is attenuated approximately 50 dB) and buffer Q2, Q3.
Pin ③ of IC1 is an input terminal for the voltage to set the RF AGC delay point. The RF AGC voltage is output to the tuner from pin ④. Pins ⑤ and ⑥ are output terminals for AFT signals. Pins ⑤ and ⑥ have inverse characteristics, and this equipment uses pin ⑤ only.
L6 connected to pins ⑧ and ⑨ is a VIF transformer.
L5 connected to pins ⑦ and ⑩ is an AFT transformer.

3. SIF

The signal input to pins ① and ⑱ of the other IC, IC2, is amplified, is SYNC detected, and is output from pin ⑭ as an SIF signal. This SIF signal is composed of a 5.5 MHz component obtained by frequency converting f_{S1} and of a 5.742 MHz component obtained by frequency converting f_{S2}.
L12 comprising pins ⑨ and ⑩ extracts f_P (picture carrier) from the amplified SWF1 output signal and uses it as a carrier for SYNC detecting. The SIF signal output from pin ⑭ of IC2 is divided into two. The other signal is fed to the 5.5 MHz ceramic filter CF1 and is input to pin ⑫ of IC2, to be output from pin ⑥ after being amplified by the SIF AMP and is FM detected (quadrature detected). This is the main audio signal.
The main audio signal is input to pin ⑥ of IC4 through RV2 for stereo separation adjustment and is input to the matrix circuit inside the IC. L10 comprising pins ⑦ and ⑧ of IC2 is a 90° phase shifting circuit for FM detecting.
The other signal is fed to the ceramic filter CF2 at 5.742 MHz and is input to pin ③ of IC3, becoming a sub audio signal to be input to the matrix circuit (IC004), after being amplified by the SIF AMP and FM detected. Needless to say, this SIF signal at 5.742 MHz is not broadcast in normal broadcast programs (broadcasts with only f_{S1} sound carrier).

4. MULTIPLEX SOUND DECODER

The Sub Audio Signal which has been obtained by FM detection within IC3 is output from pin ⑱ and branched out into 2. On the one hand, it is input into matrix IC pin ④ of IC4. On the other hand, Q4, which is comprised of L9 and C41, passes through 54 kHz (3.5 f_H) BPF and is input to pin ⑰ of IC3. This signal is AM detected (sync detected) and is output to pin ⑯ of IC3 as a Pilot Signal. The carrier for sync detection is created by PLL operation as the horizontal frequency to be input to pin ⑬ as its base. The broadcasting contents of the respective modes of audio multiplex broadcasting and the frequency of the pilot signal are shown in Table 5-1.

Broadcasting Mode	Broadcasting Contents		Pilot Signal
	Channel A (MAIN)	Channel B (SUB)	
MONO	MONO 1	MONO 1	NOISE
STEREO	$\frac{L+R}{2}$	R	117.5 Hz
BILINGUAL	MONO 1	MONO 2	274.1 Hz

Table 5-1.

The pilot signal then passes through BPF (30 to 300 Hz BPF created by R45, C48 and C49) and is input to pin ⑪ of IC3. The 117.5 Hz (during stereo) input to pin ⑪ or 274.1 Hz (during bilingual) or noise only (during monaural) of the pilot signal become DC voltage with the discrimination circuit of the narrow band, and is output from pin ⑥. This DC voltage is input to pin ③ of IC4 and controls the matrix switch as shown is Table 5-2. Pin ⑦ of IC3 is a forcible monaural input pin and when it is mode to "H" (>2Vdc), pin ⑥ becomes 6V dc. Moreover, during monaural, if the noise of pin ⑱ output of IC3 is detected at Q23 and pin ⑦ is made to "H", it ensures the monaural/audio multiplex mode discrimination operation.
During channel switching, Q5, Q6 and Q7 resets to reference voltage the error voltage of the phase detector, and ensures the response to the signal of the next channel.

Broadcasting Mode	IC4						
	INPUT VOLTAGE	AUDIO OUTPUT		AUDIO OUTPUT		SWITCHING OUTPUT	
	Pin ③	Pin ①	Pin ⑬	Pin ⑨	Pin ⑩	Pin ⑦ *	Pin ⑧ *
MONO	6V dc	MONO 1	MONO 1	MONO	MONO	OFF	OFF
STEREO	12V dc	R	L	R	L	ON	OFF
BILINGUAL	0V dc	MONO 2	MONO 1	MONO 1	MONO 1	OFF	ON

** When voltage of pin ② is set to 0V dc.*

Table. 5-2.

The audio signal is output during stereo broadcasting (L) or during bilingual broadcasting (MONO1) after passing through Q13 buffer from pin ⑬ of IC4.
The audio signal is output during stereo broadcasting (R) or during bilingual broadcasting (MONO2) after passing through Q14 buffer from pin ①.
The audio signal is output during stereo broadcasting (L+R) or during bilingual broadcasting (MONO1) after passing through Q15 buffer from pins ⑨ and ⑩.

In addition, the horizontal frequency signal of pin ⑬ of IC3 must be in synchronization with the video signal. Therefore, the Q3 emitter video signal is input to IC9, and the synchronized separation and half H killer processing are performed, and horizontal frequency pulse is obtained at pin ⑧ of IC9. This pulse is input to IC10, and after the noise component is eliminated by the PLL circuit, it is input to pin ⑬ of IC3.

5-2. SIGNAL SYSTEM (EV-S700UB)

1. TUNER

The broadcast signals input from the AERIAL IN terminal are amplified approximately 4 dB by the RFU (RF modulator, booster, and mixer) and are input to the RF input terminal of the tuner (sensitivity select switch: DX position).
The broadcast signals are output from the IF output terminal after being tuned, amplified, and frquency converted by the tuner. Each of the signals has three frequency components, namely, 39.5 MHz as a picture carrier (f_P), 33.5 MHz as a sound carrier (f_S).

2. VIF

The signals are amplified by a preamplifier comprising Q1, L1 and L2 and are spectrum shaped by a surface acoustic wave filter (SAWF) SWF1.
Then the signal input to pins ① and ⑯ of IC1 is after amplified by the VIF AMP and is output from pin ⑫ of IC1 as a video signal after being SYNC detected. The video signal is output to the video circuit through the sound trap CT1 (6.0 MHz is attenuated approximately 50 dB) and buffer Q3.
Pin ③ of IC1 is an input terminal for the voltage to set the RF AGC delay point. The RF AGC voltage is output to the tuner from pin ④. Pins ⑤ and ⑥ are output terminals for AFT signals. Pins ⑤ and ⑥ have inverse characteristics, for AFT signals. Pins ⑤ and ⑥ have inverse characteristics, and this equipment uses pin ⑤ only.
L7 connected to pins ⑧ and ⑨ is a VIF transformer.
L8 connected to pins ⑦ and ⑩ is an AFT transformer.

3. SIF

The SIF signal is extracted and input to pin ⑧ of IC3 by the 6 MHz BPF (CF1) from the video signal of pin ⑩ output of IC1.
The SIF signal, after being amplified and limited within IC3, is FM detected and output as audio signal from pin ④.

5-3 OTHER CIRCUITS

- The figures in brackets [ ] are Ref. No. of EV-S700UB or frequency.

The PWM signal from the timer microcomputer (IC001 of FT-3C/D board) passes through Q16 and Q17 [Q4 and 6] and converted into DC current and is supplied to VC pin of tuner (TU1). The local oscillation frequency of the tuner is determined by this VC pin voltage. The AFT voltage corresponding to the local oscillation frequency of the tuner is output from pin ⑤ of IC1.
The DC voltage of pin ⑤ is fed to the comparator of IC7 [IC5]. At the com-parator, if the local oscillation frequency becomes lower than the center value (Receiving picture frequency + 38.9 MHz [receiving picture frequency + 39.5 MHz]) pin ⑦ of IC7 [IC5] becomes "H", and raises the local oscillation frequency. Moreover, when it becomes higher than the center value, pin ① of IC7 [IC5] becomes "L" and lowers the local oscillation frequency.
At IC8 [IC6], the signal which has been synchronously separated with Q26 [Q10] is input to pin ⑭. When the normal synchronized signal is input, pin ① becomes "H" and the Q10 [Q11] is made into "L", and notifies that the broadcast has been received to the system control microcomputer (IC101 of SS-38F/G board).

5-4. TUNING CONTROL

The tuning control is comprised of system control microcomputer, timer microcomputer and tuner IF circuit, as shouwn in the block diagram of Fig. 5-3.
The main characteristics are as follows:

(1) Manual preset by the voltage synthesizer method
(2) Channel number are 30 positions
(3) Data memory by MNOS non-volatile memory
(4) Open channel skipping/audio muting
(5) Last channel memory
(6) Direct tuning by remote control

5-4-1. Normal Mode (Ordinary Channel Tuning)

The normal mode is separated as follows:

Tuning operation < UP/DOWN tuning / Remote control direct tuning

Fine tuning < AFT / Fine tuning (Manual)

(1) UP/DOWN tuning (Main body or remote control)

When UP/DOWN button of the channel is pressed, the timer microcomputer (IC1 and IC2 of FT-3C/D board) reads out this as serial data and is transmitted to the system control micrcomputer (IC101 of SS-38F/G board). The data which is input to pin 64 S DATA TS of IC101 of this microcomputer in internally processed, and reads in from I/O of MNOS (Metal Nitride Oxide Semicductor) non-volatile memory of pins 76 , 77 , 78 and 79 , data from the channel desisated by IC101. The contents of the data are as follws.

1 PWM data 14 bit
2 BAND data 2 bits (EV-S700ES only)
3 Skip flag 1 bit

PWM data of 1 is fed to the timer microcomputer, and is fed to the tuner circuit as a PWM signal from the timer microcomputer. BAND data of 2 is directly fed to the tuner circuit, and selects the respective bands of VL, VH and U. Channel data of 3 is "1", it indicates that there is no tuning data at that position, and it is skipped is this case.

(2) Remote control direct tuning

When the position is designated by the remote control, the timer microcomputer decodes that signal, and process similar to (1) is performed and tuning is carried out. In this case, skip flag in the "1" position is also tuned, but the audio is muted.

(3) AFT (Wide AFT control)

When the tuner receives the RF signal by the tuning operation, the UP/DOWN signal of AFT is input to pins 72 and 74 of the system control microcomputer from the IF circuit, and the H SYNC detection signal ($\overline{\text{H DET}}$) to pin 70 respectively. The system control microcomputer receives these and operates fine tuning.

When UP or DOWN signal is 'H', under the condition that $\overline{\text{H-DET}}$ is "L" the PWM data to the timer microcomputer is changed, and indirectly changes the tuning voltage (VC). This operation is repeatedly performed and is continued until both UP/DOWN become "L".

(4) Fine tuning

When AFT switch (S101) is turned OFF, it becomes into fine tuning mode. This mode is able to receive tuning +/− button (S104/103). The PWM data is changed and indirectly changes the tuning voltage VC. At the point the tuning +/− button in released, the PWM data is read in to the MNOS non-volatile memory at the time, and put into memory as a new channel data of that position.

5-4-2. Preset Mode

When the SEARCH ON/OFF button (S102) is pressed, the specified voltage (approximately 3.7V dc) is input to the PRESET pin 16 of the system control microcomputer, and becomes into preset mode. The following preset is performed after the input of the preset switch.

1 Position UP/DOWN
Channel +/− button (S008, S011)
(TIMER UP/DOWN of FT-3C/D board is commonly used)
2 Channel clear
Clear button (S105)
3 Manual preset
Tuning +/− button (S104, S103)
4 Preset release

(1) Position UP/DOWN

Select the position to preset. Even if the position is changed at this point there is no change in the tuning data (BAND*1 and PWM), and the prior state is maintained.

(2) Channel clearing

The tuning data of the position when input by this button is cleared. As a result, it is set to

CH NO .... "--"
BAND *1 .... "VL"
PWM data .... "Min"
CH SKP FLG ..... "1"

and is written in to the non-volatile memory.

*1. EV-S700ES only

(3) Manual preset

When the tuning +/− button is input, it changes the PWM data of the tuning at that point, and indirectly changes the tuning voltage VC. The AFT signal and $\overline{\text{H DET}}$ signal are then detected and tuning is performed. When tuning is completed, its data is written into the non-volatile memory.

(4) Preset release

When the SEARCH ON/OFF button (S102) is pressed again at preset mode, it becomes into normal mode.

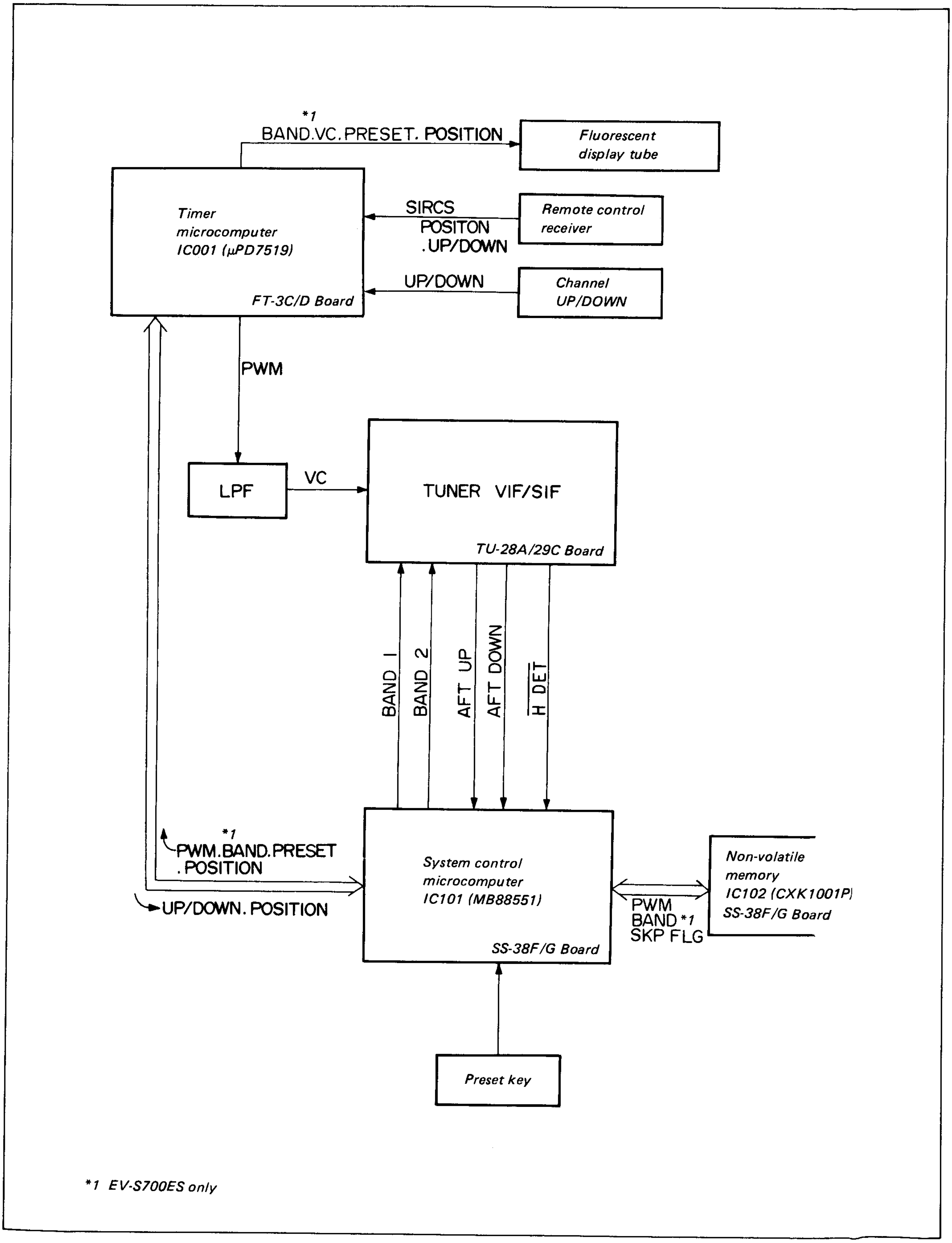


Fig. 5-3. Tuning control system block diagram

SECTION 6
AUDIO CIRCUIT

The audio circuit is divided into an analog audio system comprised mainly of PC-14B board and a digital audio system structured of PC-15B board as a central element.

6-1. ANALOG AUDIO SYSTEM

Outline of analog audio system

The analog audio system is roughly divided into:

1. Input switching circuit
2. Output switching circuit
3. Recording system circuit
4. Playback system circuit
5. AFM audio circuit
6. Level indicator
7. Headphone amplifier

6-1-1. Input Switching Circuit (PC-14B Board)

The audio input of this model is comprosed of four inputs of LINE (AV connector), AUDIO (phono jack), MIC and TU, as shown in Fig.6-1. of the block diagram of the input system thereof. First, explanation will be made mainly about Lch.

The signal applied from AUDIO input is supplied to a low-cut filter of IC605, where the unrequired component 20Hz or lower is cut off and input to analog SW IC611. This low-out filter, as shown in Fig.6-2, makes up a secondary active filter and is equipped with −2dB ATT for level matching. R370 inserted in the feedback loop is a resistor for DC offset. C370 prevents in AC fashion the short noises caused by the addition of R370.

TU input, the signal supplied from the TA board to the PC-14B board is amplified by 4dB at the IC621, and switched between LINE input signal and TU input signal by the analog SW of IC611. LINE (AV connector) input is fed to the analog SW IC611 through buffer amplifier IC008 of VI-9A board. At analog IC611, LINE input signal, TU input signal, and AUDIO input signal are switched. The relationship between input switching and control signal is shown in Table 6-1. Lch and Rch signals produced from pins ⑬ and ③ of IC611 are applied to pins ⑬ and ③ of IC612 respectively, where switching is made with MIC input. In the case of MIC input, Lch corresponds to Mono with control signals as shown in Table 6-2.

This input switching can be designated at the time of timer recording. Also, in Multi PCM mode, switching is made to AUDIO input automatically.

The signal produced from pins ⑭ and ④ of IC612 is divided into the manual VR, AGC circuit and AFM audio circuit.

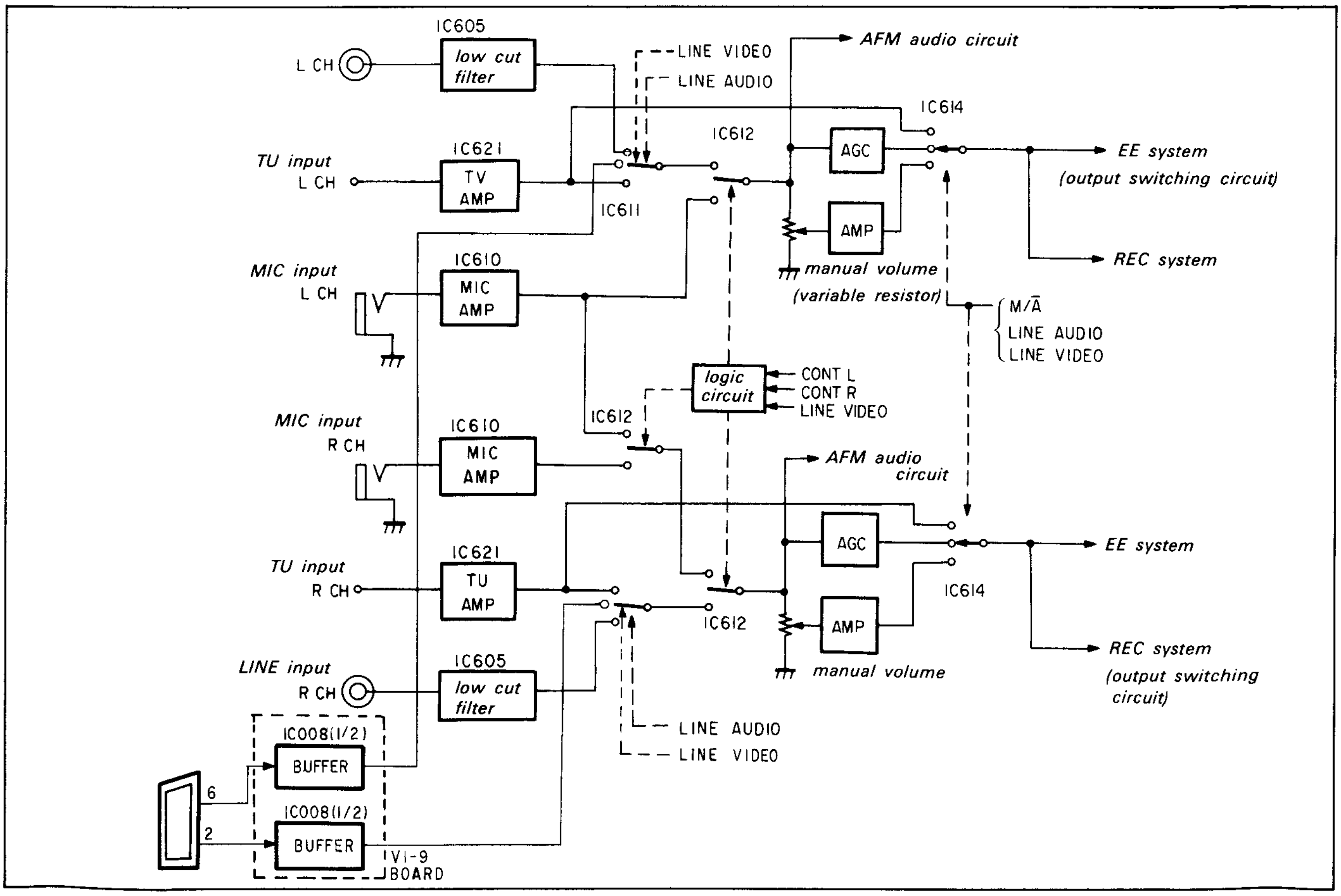


Fig. 6-1. Block diagram of input switching circuit

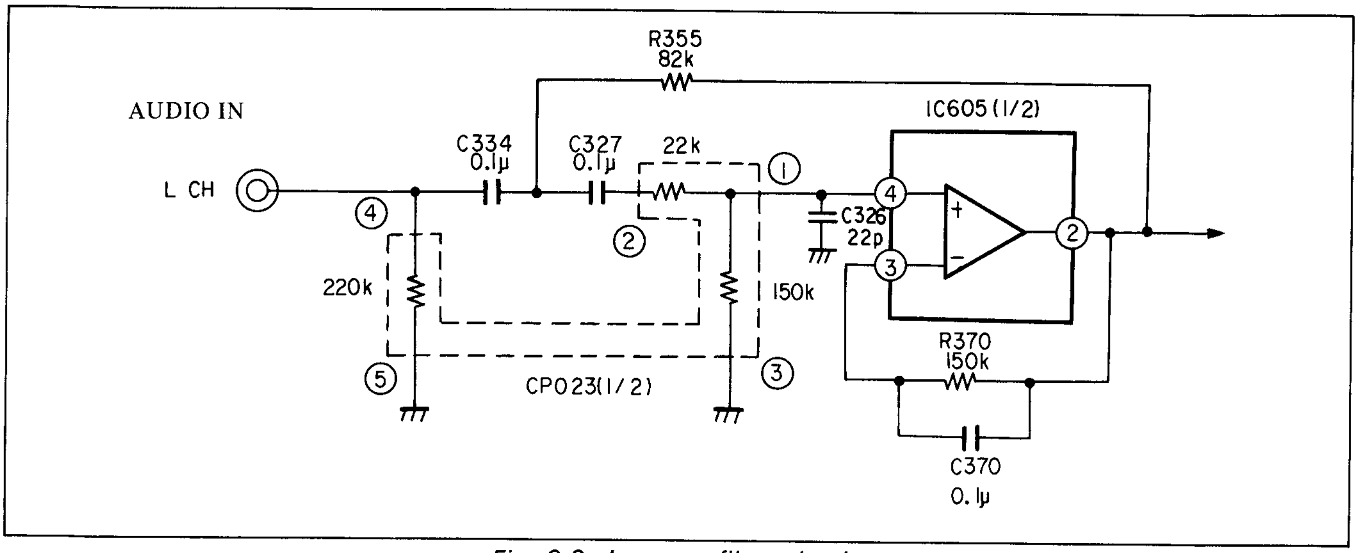


Fig. 6-2. Low cut filter circuit

Input Switching Mode	PCM Audio Circuit Input Signal		AFM Audio Circuit Input Signal
	L CH	R CH	
TUNER	TU (L)	TU (R)	TU (MAIN)
LINE	LINE (L)	LINE (R)	LINE (L) + LINE (R)
SIMULCAST	AUDIO(L)	AUDIO (R)	TU (MAIN)
AUDIO	AUDIO(L)	AUDIO (R)	AUDIO (L) + AUDIO (R)

Table 6-1(1). Functions of audio input switching circuit

Input Switching Mode \ Control Signal	LINE AUDIO	LINE VIDEO
TUNER	L	L
LINE	H	H
SIMULCAST	H	L
AUDIO	L	H

Table 6-1(2). Audio input switching control signal

Input Switching	Mike Jack		PCM Audio Circuit Input Signal		AFM Audio Circuit Input Signal
	L CH	R CH	L CH	R CH	
LINE/AUDIO	Used	Not used	MIC (L)	MIC (L)	MIC (L)
	Not used	Used	LINE (L)/ AUDIO (L)	MIC (R)	LINE(L)/AUDIO + MIC (R)
	Used	Used	MIC (L) +MIC (R)	+ MIC (R)	MIC (L) +MIC (R)
TUNER	MIC input not accepted		TU (L)	TU (R)	TU (MAIN)
SIMULCAST	MIC input not accepted		LINE (L)	LINE (R)	TU (MAIN)

Table 6-2(1). Function of audio input switching circuit when mike is used

Input Switching	Mike Jack		Control Signal			
	L CH	R CH	LINE VIDEO	LINE AUDIO	CONT L	CONT R
LINE/AUDIO	Used	Not used	H	H/L	L	H
	Not used	Used	H	H/L	H	L
	Used	Used	H	H/L	L	L
TUNER			L	L	×	×
SIMULCAST			L	H	×	×

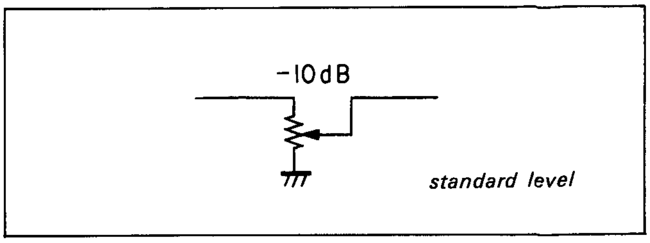
Table 6-2(2). Audio input switching control signal with mike used

(1) Manual VR

The manual variable resistor has a level margin of 10 dB, and its scale is almost at center for the standard level input.
Slide the knob on Lch side to extreme left, MANUAL/AUTO change-over is activated to AUTO Mode. The signal that has passed the menual VR is applied to pins ⑥ and ④ of IC613. This IC functions also as an equalizer to slightly raise the frequency characteristics of the low frequency area of an amplifier 10dB in gain. The signal produced from pins ⑧ and ② of IC613 is applied to the pins ⑪ , ⑭ , ④ and ⑤ of IC614 respectively.

(2) AGC circuit

The AGC circuit is shown in Fig. 6-5. The feature of this circuit lies in that its broad dynamic range (S/N:75 dB) of 80 dB or more eliminates adjustment for level matching of Lch and Rch.



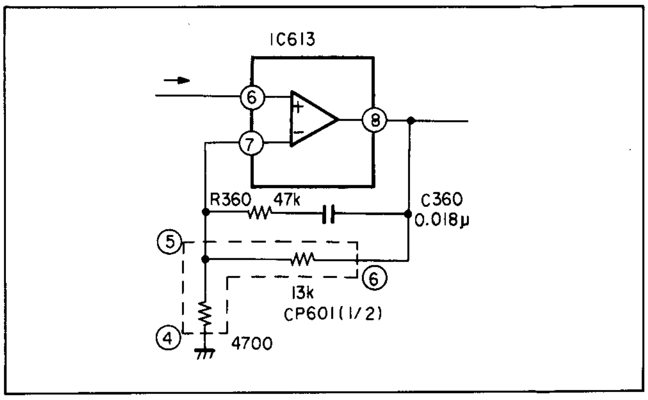


Fig. 6-4. Low-area UP EQ circuit

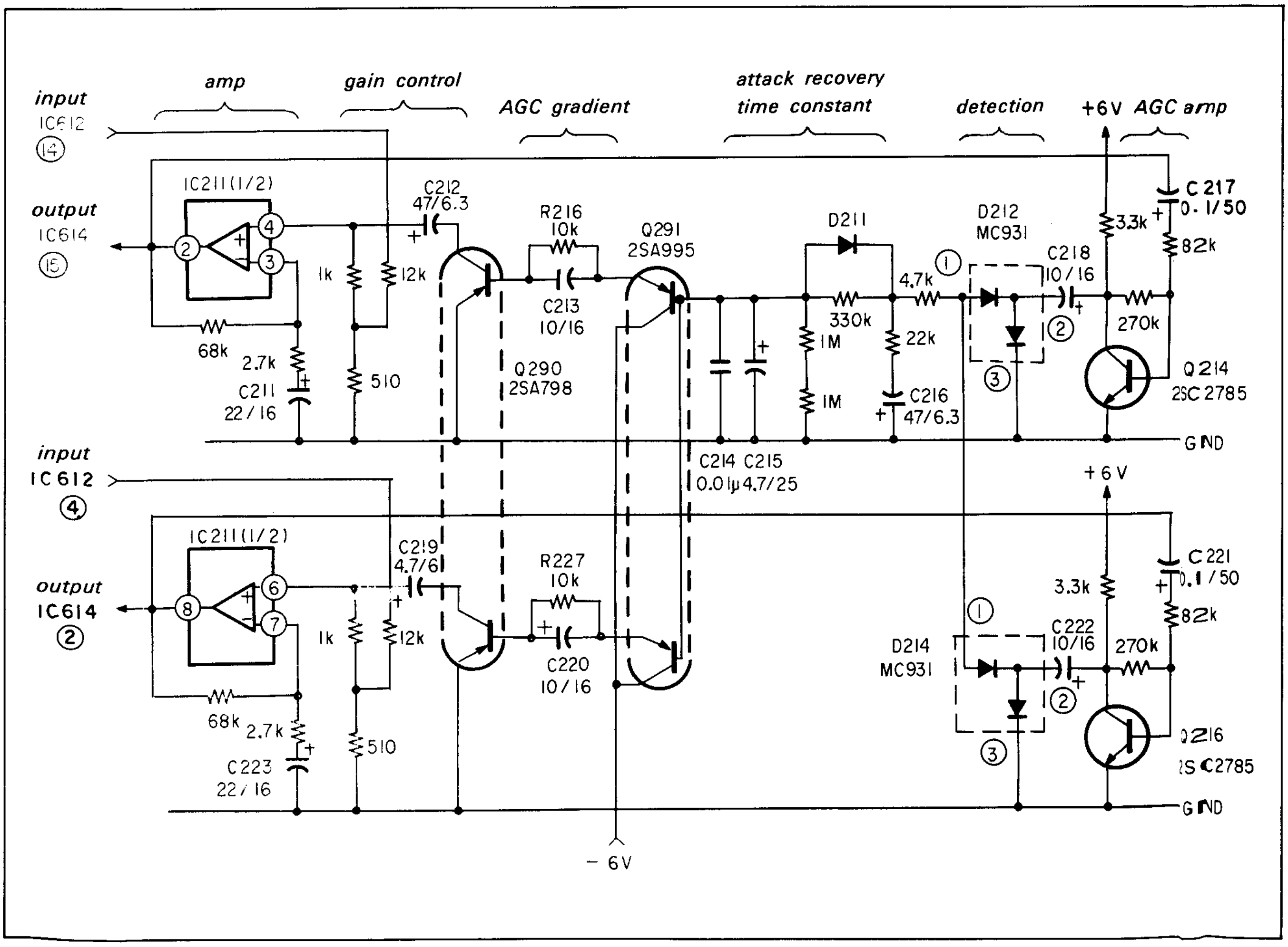


Fig. 6-5. AGC circuit

The block diagram of AGC circuit is shown in Fig.6-6. The signal applied is lowered to AGC operating level by ATT, and then applied to the gain control circuit.
In this circuit, the level is controlled by part of the output signal detected by the AGC DET circuit.
Then, the signal is amplified to the original level by the amp and produced. Fig. 6-5. shows an actual circuit. The signal produced from pins ⑭ and ④ of IC612 is attenuated by about 28 dB at the resistor ATT (attenuator), and through a 1 kΩ resistor, applied to pins ④ and ⑥ of IC211. The signal is then amplified by about 28 dB in this IC, and produced by way of pins ② and ⑧. Part of the output signal of pins ② and ⑧ of IC211 is applied to Q214 and Q216 respectively, which make up amplifiers by the gain of which the starting point of AGC operation is set. The signal produced from the collector of Q214 and Q216 is detected by D212 and D214, and with their time constants determined for AGC response by the next C and R, are applied to the base of Q291. Q291 provides emitter-follower connection, and by controlling the base current of Q290, by the detection siganl, the collector-emitter resistance of Q290 changes thereby to control level by the attenuation effect with 1kΩ resistor. (See Fig. 6-7.) The resistors R216 and 277 inserted between emitter of Q291 and the base of Q290 set the base current of Q290. Q290 and Q291 are dual transistors for dampening the difference in ATT amount between Lch and Rch.

The signal produced from pins ② and ⑧ of IC221 is applied to pins ⑮ and ② of IC614 respectively. The signal that has passed the manual VR circuit, and AGC circuit is being applied to analog SW of IC614, in which MANUAL/AUTO switching is effected. In the process, TU input is applied in addition to the two inputs. The TU input signal is not passed through neither manual VR nor AGC circiut, and this TU direct signal is selected only when the input switching is set to [TUNER] mode and the recording level adjustment to [AUTO].
The signal produced from pins ⑬ and ③ of IC614 is applied dividedly to E-E output circuit and REC system circuit.

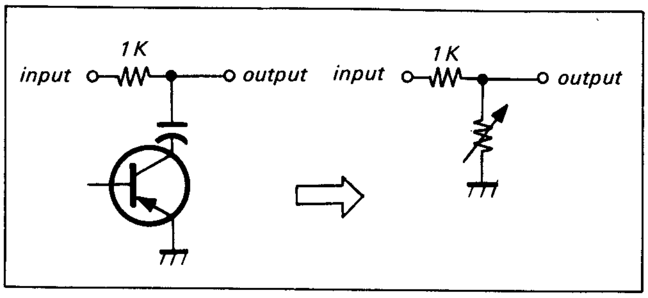


Fig. 6-7. Gain control

6-1-2. Output Switching Circuit (PC-14B Board)

The signal produced from pins ⑬ and ③ of IC614 is applied through resistor ATT (−2 dB) to the pins ⑤ and ⑭ of IC614 respectively. IC608 switches E-E/PB signals and mute them at the same time. The signal thus switched is produced to pins ③ and ⑬ and applied to IC609. In IC609, as shown in Fig. 6-8, MAIN/SUB for receiving bilingual is effected to select output meeting the designated mode.
The relationship between function and control signal is shown in Table 6-3.
The signal produced from pins ③ and ⑬ of IC609 is passed through R309, 409 to pins ④ and ⑥ of IC606 respectively. Q301, 401 are muting transistors used in opposite connection for preventing click noise. (Fig. 6-9.)

IC606 is an output amp which is used as a differential amp to mix PCM audio signal and AFM audio signal, so that PCM audio signal is applied to non-inverted input terminal and the AFM audio signal with phase inverted to the inverted input terminal. (Fig. 6-10.)
In the case where PCM audio signal and AFM audio signal are produced independently, one of them is muted.
Table. 6-4. shows the functions and control signals related to them.

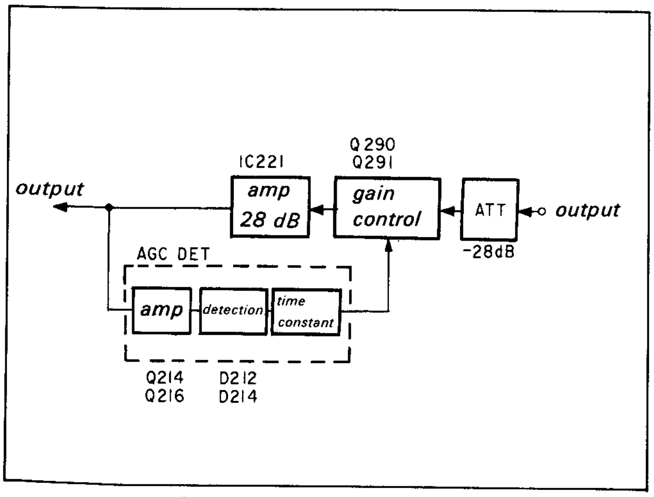
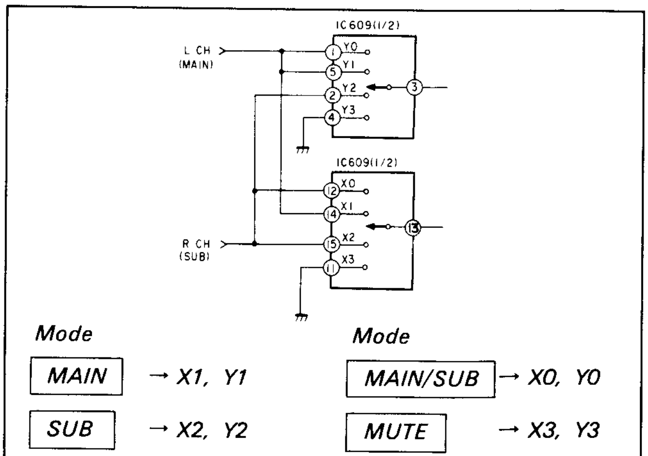


Fig. 6-6. AGC block diagram



※ During STEREO mode switching position becomes to X0, Y0 regardless of AUDIO MONITOR SWITCH position (MAIN/SUB switchover).

Fig. 6-8. MAIN/SUB switching circuit

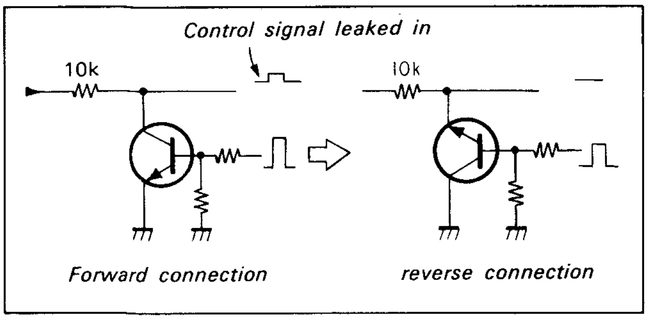


Fig. 6-9 Mute circuit

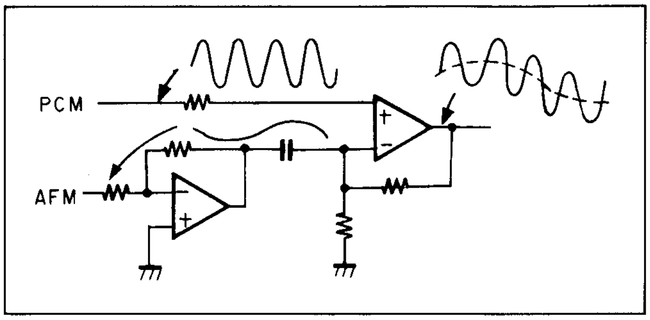


Fig. 6-10 PCM and AFM audio mixing circuit

※ STEREO mode is achieved without regard to the position of the audio monitor change-over switch (MAIN/SUB switch)

Audio Monitor Mode \ Output	PCM Audio Output L CH	PCM Audio Output R CH	AFM Audio Output
MAIN/SUB	MAIN	SUB	MAIN
MAIN	MAIN	MAIN	MAIN
SUB	SUB	SUB	MAIN
STEREO※	L	R	L+R

Table 6-3(1). Audio monitor switching function (MAIN/SUB switch)

Control Signal \ Audio Monitor Mode	MAIN/SUB	MAIN	SUB	STEREO※
PCM1	L	H	L	L
PCM2	L	L	H	L
LINE VIDEO	L	L	L	

Table 6-3(2). Audio monitor control signal (MAIN/SUB switch)

Audio Monitor Mode \ Audio Output	LINE OUT/AUDIO OUT L CH	LINE OUT/AUDIO OUT R CH	RF OUT
AUTO PCM	PCM (L)	PCM (R)	PCM (L) + PCM (R)
MIX	PCM (L)+AFM	PCM (R)+AFM	PCM (L) + PCM (R) + AFM
AFM (Standard)	AFM (MONO)	AFM (MONO)	AFM (MONO)

Table 6-4(1). Audio monitor switching function (PCM/STANDARD switch)

Control Signal \ Mode / Audio Monitor Mode	REC PCM	REC MIX	REC AFM	PB PCM	PB MIX	PB AFM
$\overline{\text{AUDIO PB}}$	H	H	H	L	L	L
AFM MUTE	H	L	L	H	L	L
AFM	L	H	H	L	H	H
PCM1	L	L	H	L	L	H
PCM2	L	L	H	L	L	H
PCM PB MUTE	×	×	×	L	L	H

Table 6-4(2). Audio monitor switching control signal (PCM/STANDARD switch)

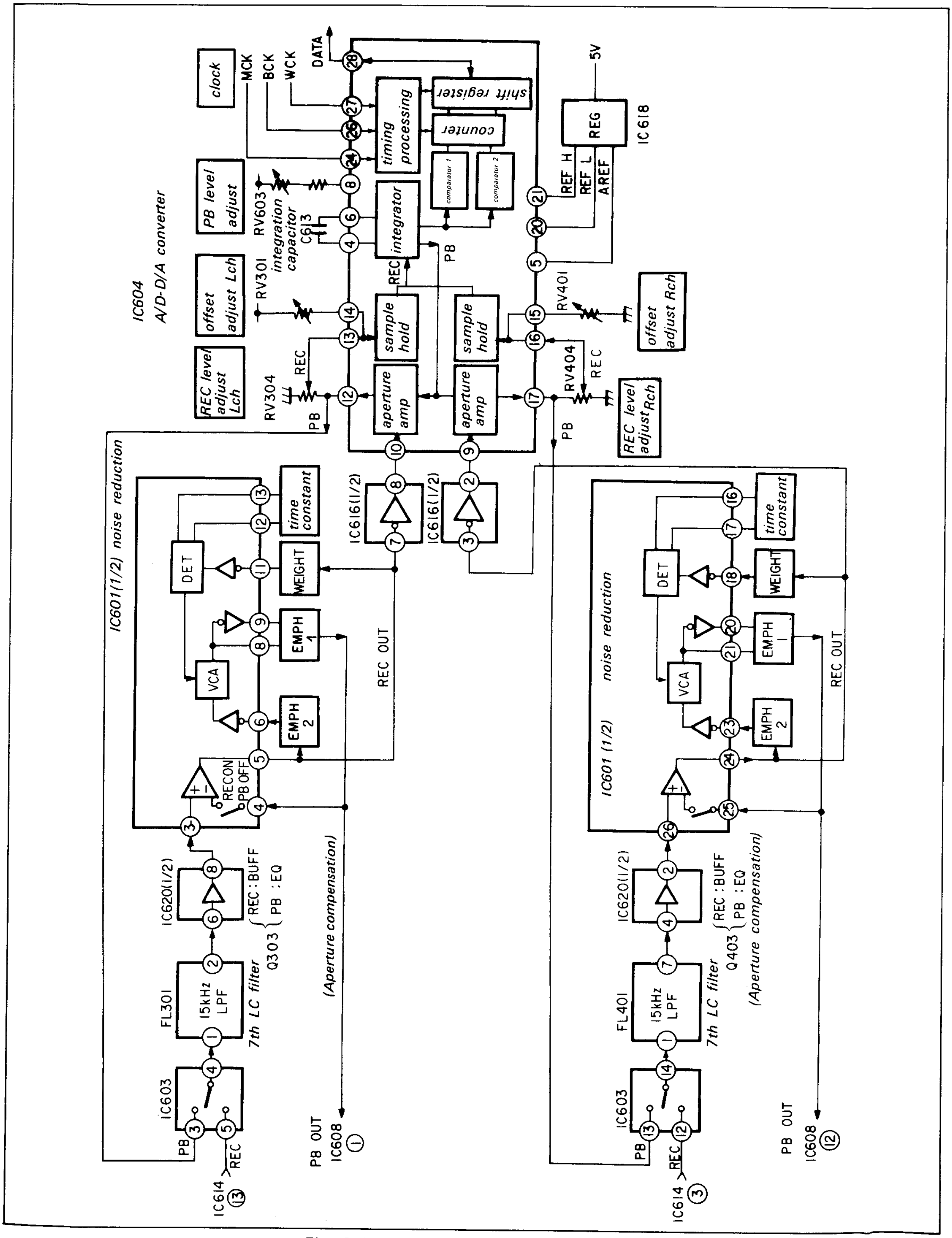


Fig. 6-11. REC.PB system block diagram

6-1-3. Recording System Circuit (PC-14B Board)

A block diagram of the recording system is shown in Fig. 6-11. This circuit also functions as a playback system circuit which is switched by REC/PB.
The signal from pins ⑬ and ③ of IC614 is applied to pins ⑤ and ⑫ of IC603 of the REC/PB change-over switch and output by way of pins ④ and ⑭ respectively. These signals are applied to low-pass filters FL301 and 401 in which unnecessary portions above 15 kHz are eliminated. IC620 functions differently in REC and PB modes, being switched by Q303 and Q403 to operate as a buffer in REC mode and as an aperture-compensating equalizer in PB mode.

(1) 15 kHz low-pass filter

This low-pass filter is one of the parts which determines the frequency characteristics of the audio section of this model. PCM is originally an analog signal which is changed to a digital signal by being segmented along the time axis (sampling) and along the level direction (quantization). The sampling theorem requires a frequency of at least twice the maximum frequency of the signal. The reason is that as shown in Fig. 6-12, and specifically, in (a) showing a spectrum of the original signal, in the case where a signal with maximum frequency fu is sampled by frequency fs, the spectrum distribution thereof takes the form as shown in (b) in which in addition to the original signal, the same spectrum as the original signal is distributed symmetrically with respect to the sampling frequency fs.
If this signal is to be demodulated, the spectrum added must be eliminated by the low-pass filter.
In the case where the frequency of the original signal is higher than one half of the sampling frequency, the spectrum obtained by sampling is undesirably mixed with that of the original signal as shown in (c), and, as a result, even if the added spectrum is cut by the low-pass filter at the time of demodulation, the mixed parts fail to be eliminated. This superimposition of spectrums is called a "fold" and causing a fold noise.
In the PCM audio system of 8 mm video, the sampling frequency is 31.25kHz (2fH), and therefore, the maximum frequency that can be handled is 15.625kHz. As a result, before sampling the audio signal, it is always necessary to to cut the high components higher than 15.625kHz of the audio signall the opw-pass filter. It is desirable for an audio device to have as superior high frequency characteristic as possible while at the same time attenuating the frequencies higher than 15.625kHz sharply. Filter designing, therefore, requires utmost care. In order to prevent faulty operation by noise reduction (mismatching due to characteristic difference between recording and playback input signals), L.P.F is inserted in the input stage of the noise reduction.

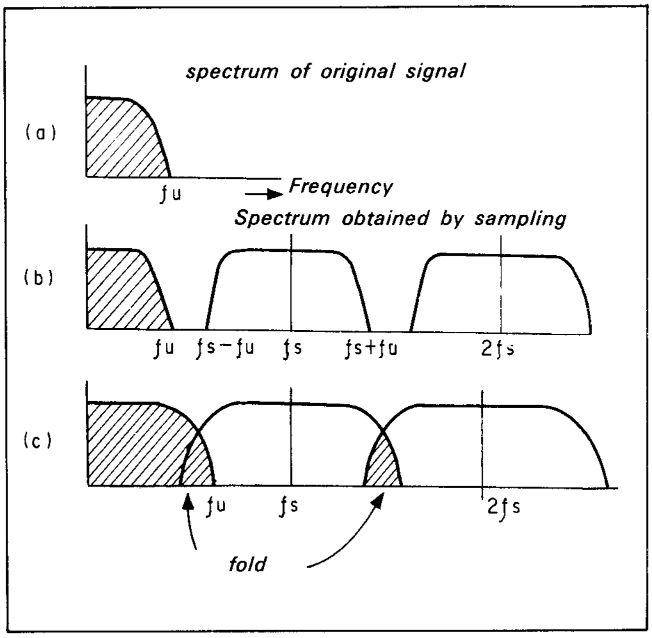


Fig. 6-12. Spectrum distribution

(2) Noise reduction circuit

In the PCM audio system of 8 mm video an analog noise reduction is employed to compensate for the shortage of dynamic range at the digital portion. Fig. 6-13 shows the system thereof and Fig. 6-14 the circuit involved. Let me explain about Lch. The signal supplied from pin ③ of IC601 is applied to MOA (main operational amp). MOA operates as an operational amp with positive input at pin ③ and negative input at pin ④ in REC mode. A signal with the high frequency region reduced by the emphasis 1 and emphasis 2 circuits (both fixed emphasis circuits) including C and R is fed to the negative input pin ④ of MOA, and therefore, the gain of MOA is subjected to pre-emphasis by being raised in the high frequency rgion. On the other hand, VCA (voltage control amp) has a gain which is reduced with the input level of the DET (detection circuit), so that with the lowering of the signal level applied to DET circuit input (pin ⑪), the gain of MOA increases to compress the signal (2:1).

In the process, a weighting circuit having a frequency characteristic opposite to the emphasis 2 circuit is added to the DET circuit input, and if a signal of the high frequency region alone is applied thereto, the VCA gain is raised to offset the amount of emphasis by the emphasis 2 circuit.
The attack time, recovery time and hold time of NR circuit are determined by the capacitors of pins ⑫ and ⑬ .
Fig. 6-15 shows the NR encode characteristic and Table. 6-5. an NR format.

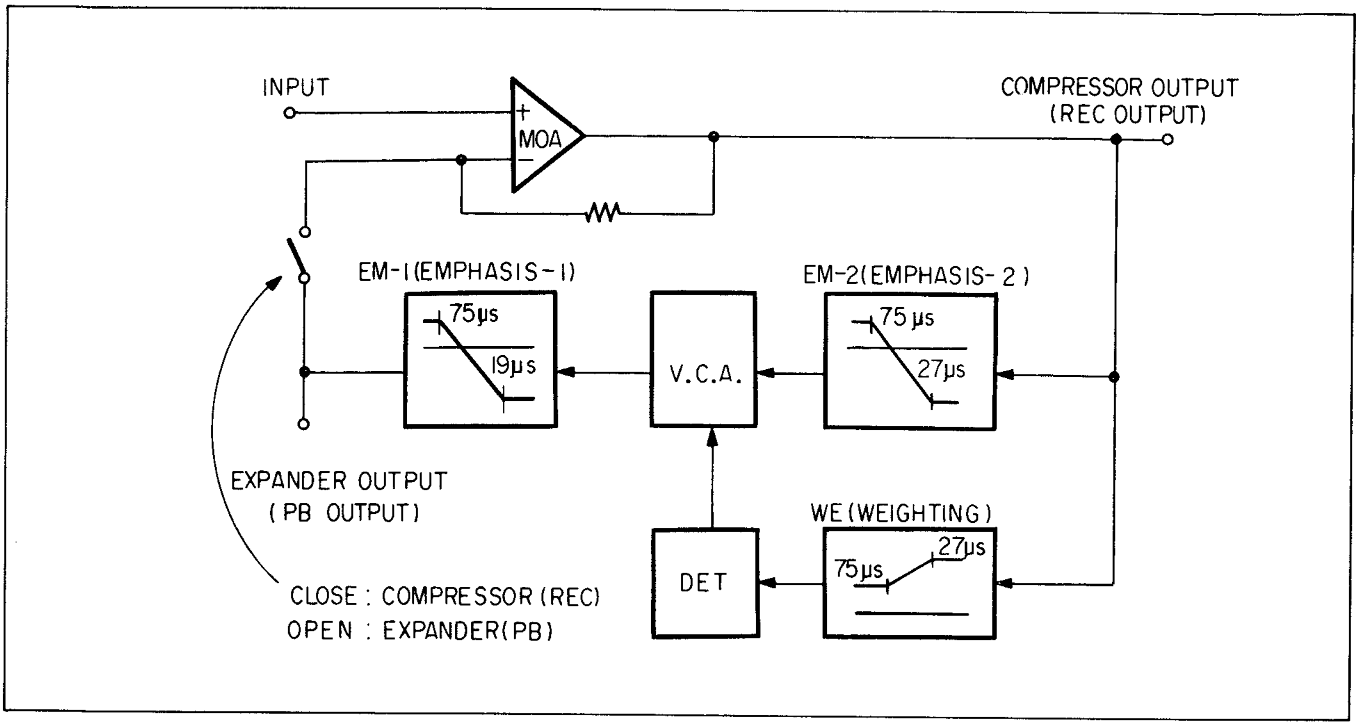


Fig. 6-13. PCM audio NR system

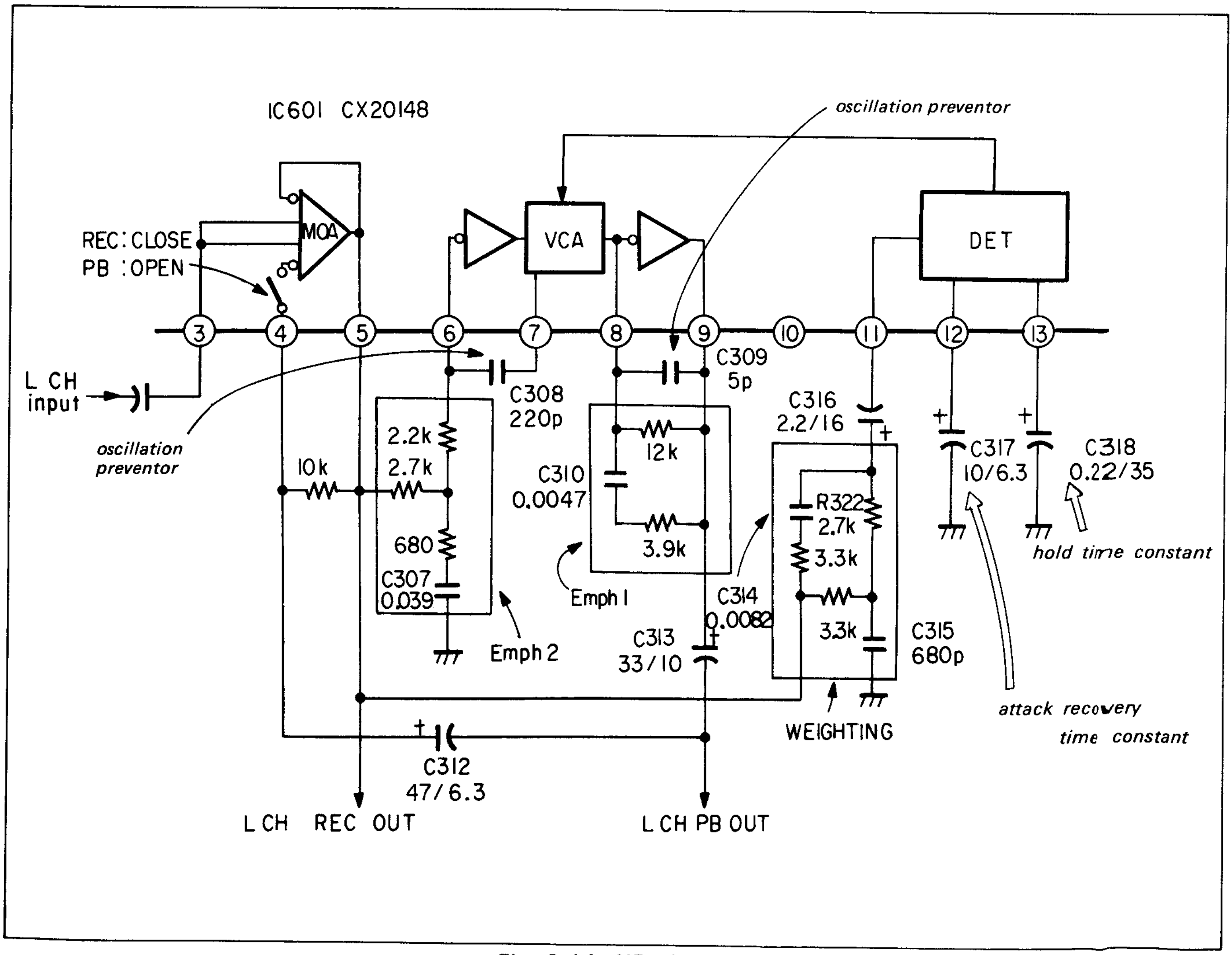


Fig. 6-14. NR circuit

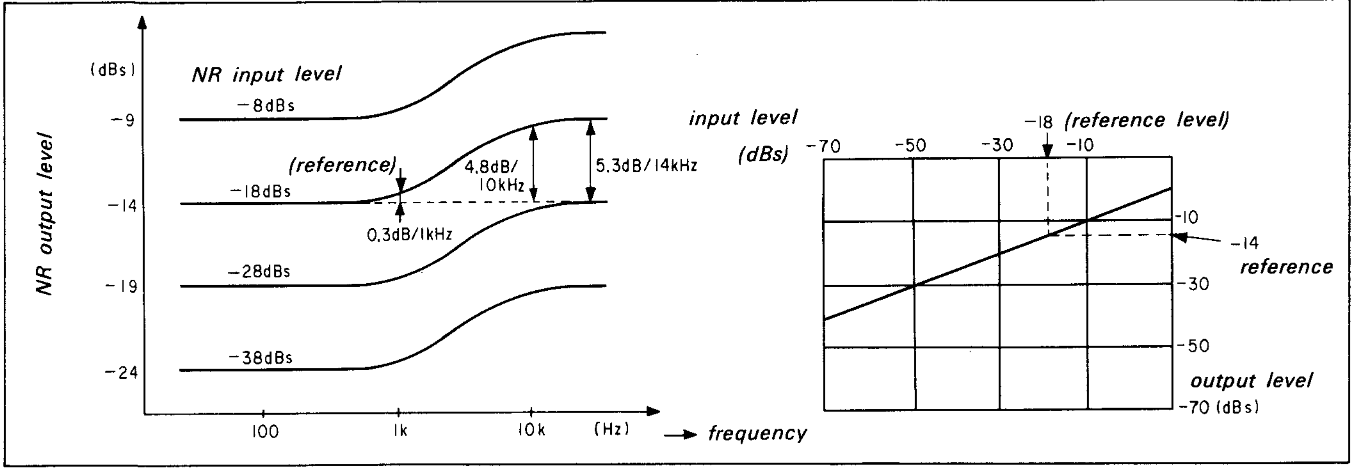


Fig. 6-15 NR encode characteristic

[Noise reduction format]

Item	Spec	Condition
Preemphasis	Fixed	
Compression ratio	2	
Time constant Pre-emphasis 1 Pre-emphasis 2 Weighting	 75 μs, 19 μs 75 μs, 27 μs 75 μs, 27 μs	Cut-off frequency 2.12 kHz, 8.38 kHz 2.12 kHz, 5.89 kHz 2.12 kHz, 5.89 kHz
Transient characteristic Attack time Recovery time Hold time	 3 ms 40 ms Allowance±20% 15 ms	
Frequency characteristic (compressor)	See frequency characteristic	Reference input level
Linearity	See noise reduction input/output characteristic	Compressor input 400 Hz, −60 dB Expander input 400 Hz, −30 dB

[Frequency characteristic (compressor at time of recording)]

Frequency (Hz)	50	100	200	400	700	1K	2K	4K	7K	10K	14K
Response (dB)	0	0	0	0	+0.1	+0.3	+1.2	+2.7	+4.1	+4.8	+5.3

Allowance±1.5 dB

[Noise reduction input/output characteristic]

Compressor

Allowance±1.5 dB: LC

Expander

Allowance±3.0 dB: LE

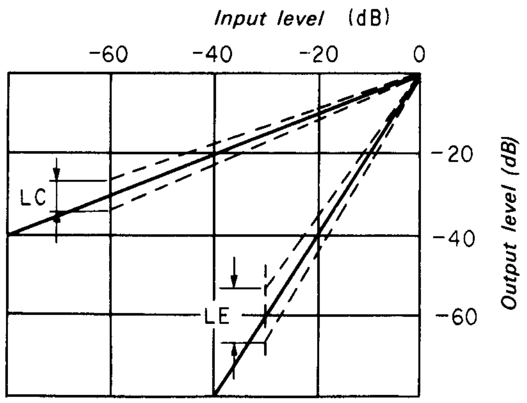


Table 6-5. 8 mm-video audio NR format

(3) A/D converter circuit (PC-14B Board)

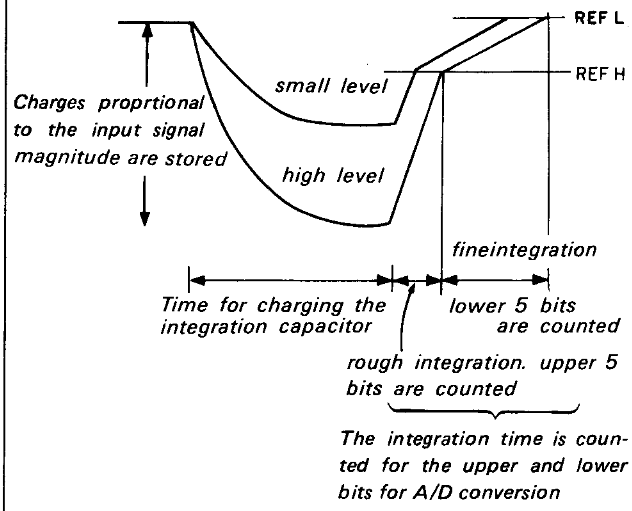
IC604 (CX23060) provides a 10- bits A/D-D/A converter of the integrated cascade connection type. (Fig.6-17.)
The signal produced from pins ⑤ and ㉔ of IC601 is applied to pins ⑦ and ③ of IC616 respectively, and reduced by 2 dB in gain at an inverted amplifier, followed by production at pins ⑧ and ② and appplication to the A/D converter (IC604) to be converted into 10-bits data.
The signal applied to the analog input terminal of the pins ⑩ and ⑲ of IC604 is amplified by about 12.5 dB by an aperture amp and produced at pins ⑫ and ⑰. This signal is reduced by about 6 dB at a semifixed resistor, and at the same time is adjusted in REC level. After that, the signal is applied to pins ⑬ and ⑯, and by the sample-holding amp, amplified by about 4 dB followed by being applied to an internal integrator. At the sample hold amplifier, a convert command (C.C) generated by a word clock (WCK) supplied from pin ㉗ and a bit clock (BCK) supplied from pin ㉖ are used to sample the analog signal during the "H" section of C.C, so that a constant current weighed in reverse characteristics and the input signal are integrated during the "L" section of C.C to effect A/D conversion. In the process, the current is divided into rough and fine constant currents for integration and the integration time of each current is counted by the counter to generate a 10-bits data. (Fig.6-16.) Specifically, the integration time with the rough constant current represents the most significant 5-bits data, and the integration time with fine constant current the lesssignificant 5-bits data. When the convert command is raised to "H" again, the data is loaded on a shift register, and in sync with the rise of the bit clock, produced serially from pin ㉘ led by LSB. The timing for A/D conversion is shown in Fig.6-18. The data for Lch and Rch are produced alternately, data code being 2's complement.
The 10-bits data produced from IC604 (pin ㉘) is applied to the digital processing circuit (PC-15B board). Pin ㉘ makes up a data output terminal in the REC mode, and an input terminal inthe PB mode.

(Offset adjustment)

PCM audio system for 8 mm video employs nonlinear quantization by 10-bits ⇄ 8-bits compression/expansion of digital data. Therefore, in the case where the data output of A/D converter contains a DC offset, the distortion increases. In order to compensate for this DC offset, an offset, an offset current is applied to the offset input terminal of pins ⑭ and ⑮ of IC604 and adjustment is made by the VR to attain data output of "00000000" in the absence of signal.

[Oprating principle of A/D converter]

Charges corresponding to input analog voltage are stored in the integrating capacitor for integration with the constant current of the reverse characteristic, and the time required is counted by the digital counter to produce data.



[Operating principle of D/A converter]

Clocks are counted by the number of input digital data by the operation reverse to A/D converter, and during the counting operation, and a predetermined current is integrated to produce an output voltage corresponding to the digital data.

Fig. 6-16. A/D-D/A converter

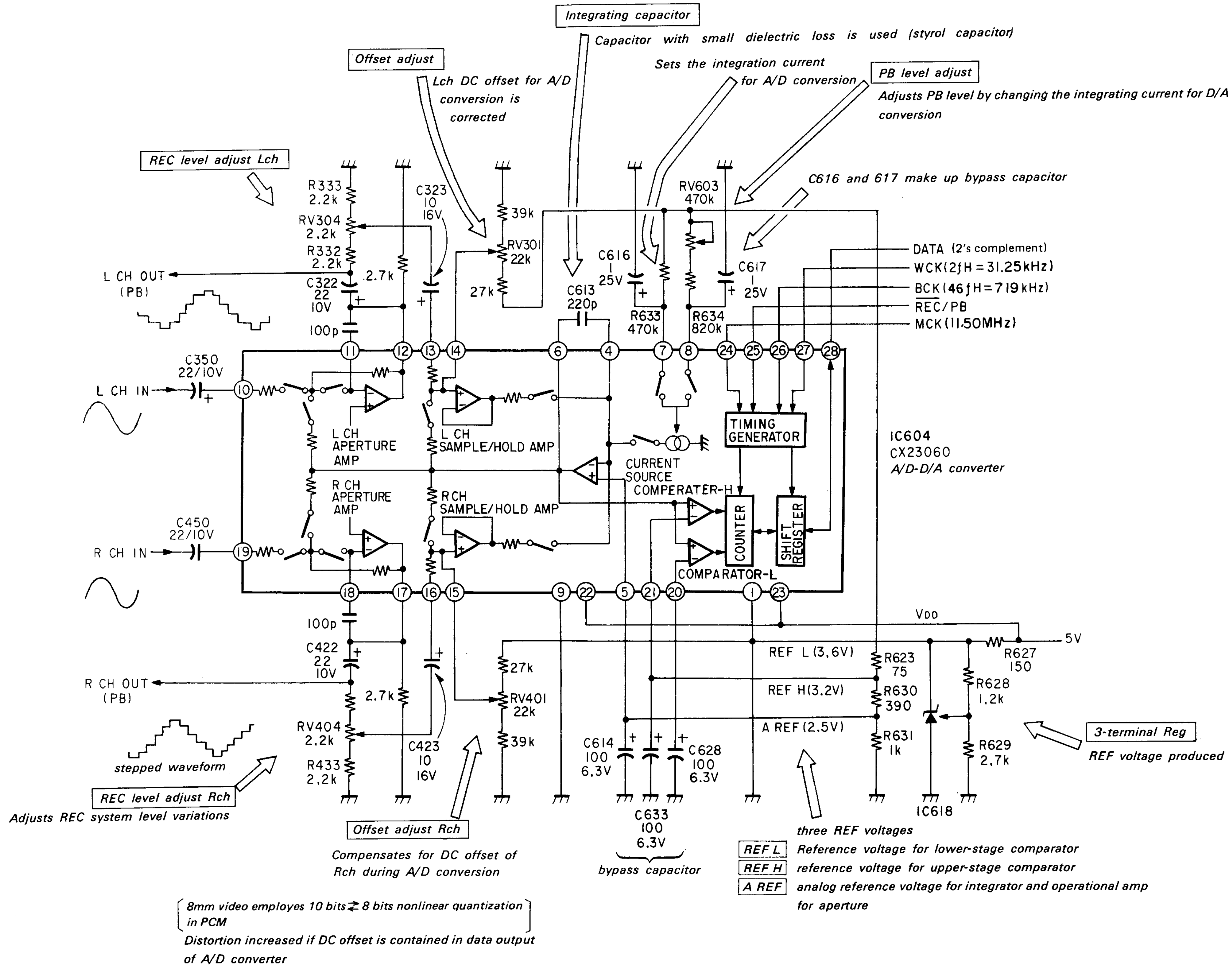


Fig. 6-17. Operating principle of A/D-D/A converter.

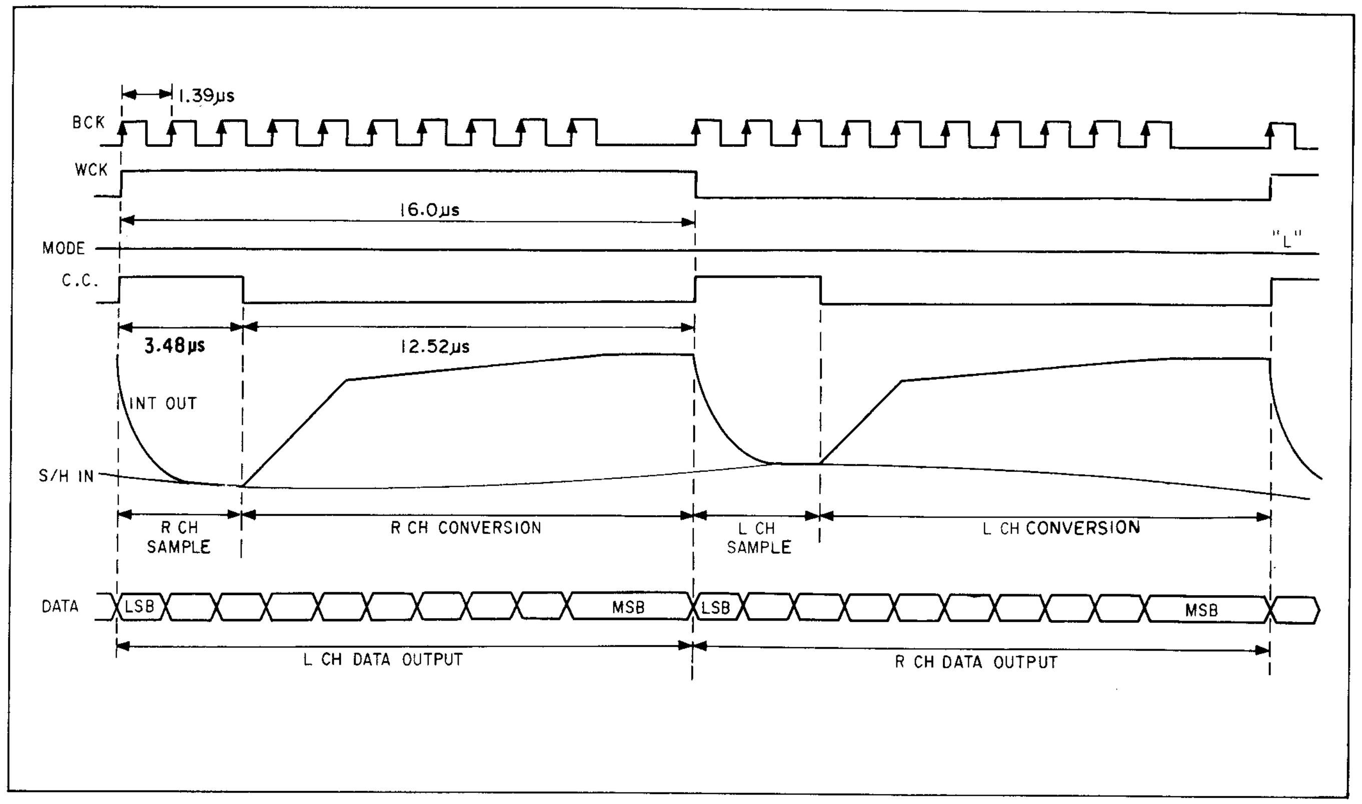


Fig. 6-18. Timing chart for A/D conversionm mode (REC mode)

6-1-4. Playback System Circuit (PC-14B Board)

The playback system circuit operates also as a recording system circuit by the change over switch.

(1) D/A converter circuit (See Fig. 6-16.)

The 10 bits serial signal supplied from the digital processing section is applied to pin ㉘ of IC604. The D/A converter operates on the principle of reverse to A/D converter, or specifically, a constant current is integrated by the integrator for the time period corresponding to the magnitude of the digital data to produce an analog output voltage representing the data. The serial data applied led by LSB is received by a shift register in sync with the fall of the bit clock, and set in a counter immediately before the rise or fall of the word clock. (Fig. 6-19). The word clock (WCK) from pin ㉗ and the bit clock (BCK) from pin ㉖ are used to generate a discharge clock (DIS). First, during the section where the discharge clock is "H", the integration charges obtained by previous conversion are discharged, and the integration output potential is initialized to an analog reference voltage. Then, when the discharge clock is reduced to "L", the counter begins to count from the set value, while a constant current with an weight attached corresponding to the data is applied to the integrator whereby integration is performed. When the counter produces a carry signal, the count and the constant current stop at the same time as integration. In the process, the integration output held at the integration capacitor is amplified by about 3.3 dB at the aperture amp and produced at pins ⑫ and ⑰ of IC604. The waveform at this time takes a stepped form as shown in Fig. 6-20.

Pin ⑧ of IC604 is a terminal supplied with the integration current for D/A conversion. Since the output voltage of the integrator is determined by the value of the integration current, however, the variable resistor (RV603) is used to adjust the D/A conversion gain and hence the PB level.

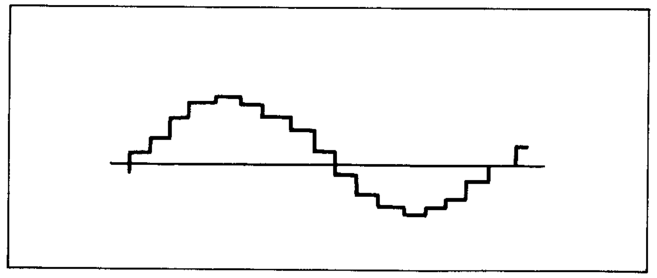


Fig. 6-20.

(2) Low-pass filter, aperture compensation circuit

The signal D/A converted is produced from pins ⑫ and ⑰ of IC604 respectively, and applied to the REC/PB change-over switch pins ③ and ⑬ of IC603 then after being produced from pins ④ and ⑭, applied to FL301 and 401. The signal after D/A conversion contains an unnecessary spectrum component generated at the time of sampling, which is eliminated by a 15 kHz low-pass filter. The cut-off frequency is the same as in REC mode, and therefore the filter used for REC system is used.
After FL301 and 401, the signal is applied to pins ⑥ and ④ of IC620. This circuit, which is a mere buffer amp during REC, makes up an equalizer amp for aperture compensation at the time of PB. (Fig. 6-21.) By the aperture compensation is meant

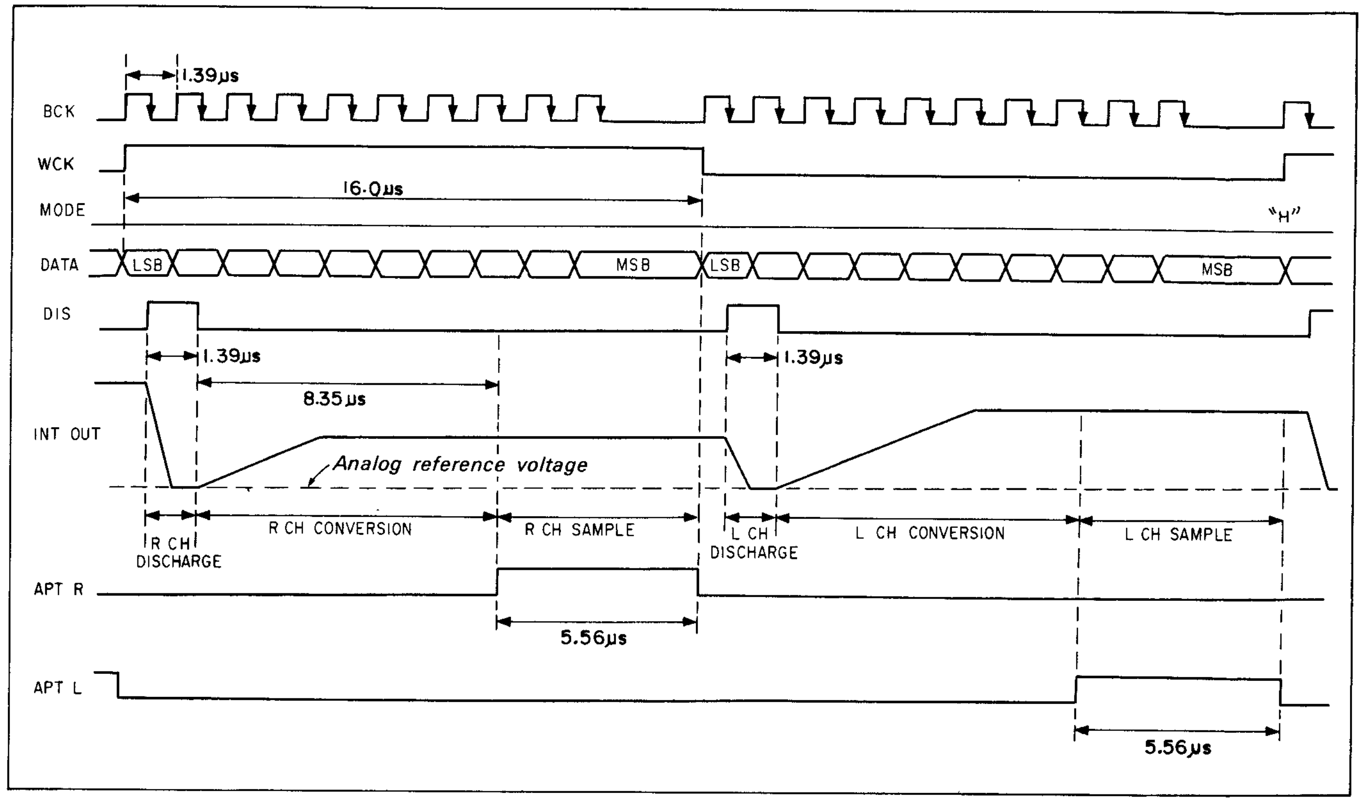


Fig. 6-19. Timing chart for D/A conversion mode (PB mode)

the operation mentioned below. When a signal is sampled, the signal could not ideally be completely demodulated unless the pulse width for sampling is infinitely long. A widened pulse frequency characteristics after demodulation at the high frequency region. (Aperture effect) In this model in which the duty factor of this pulse is widened to 100% to improve S/N, the frequency characteristic is lowered by about 2.5dB at or around 14kHz by the aperture effect. This can be compensated for by either of two ways; one by narrowing the pulse duration by switch, the other by compensating for the deteriorated frequency characteristic by revirse characteritic. In the former method, the deterioration of the frequency characteristic can be reduced to about 0.2dB if the pulse width is set to about 1/4, though at the sacrifice

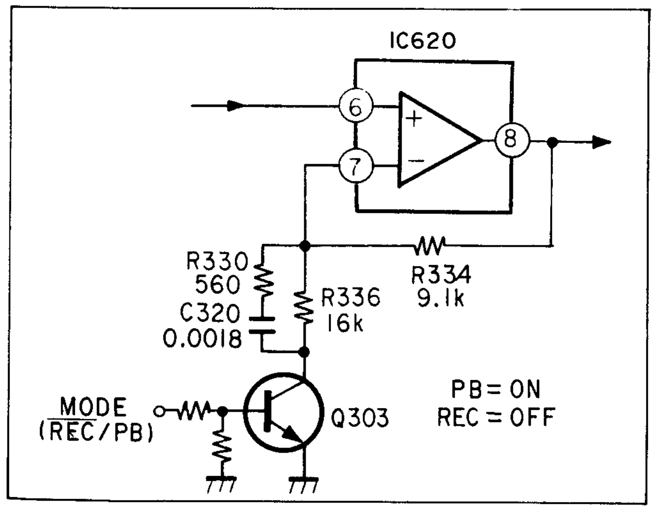


Fig. 6-21. Aperture compensation circuit

of S/N. To stress the importance of S/N, however, the frequency characteristic deterioration is compensated for by the latter method employing an equalizer in this model. this equalizer also functions as a 2dB amplifier.

(3) Noise reduction circuit

The audio signal compressed and pre-emphasized at the time of REC is expanded and de-emphasized to the original state. As a result, the noise level occurring in the processes of recording and playback is relatively reduced.
See Figs. 6-13 and 6-14. Let us explain about Lch. The signal applied from pin ③ of IC601 is supplied to MOA (main operational amplifier) which operates as a buffer amp in the PB mode. The high frequency level of the audio signal produced from the buffer amp is reduced at emphasis 2 and emphasis 1 circuits for de-emphasis operation. VCA (voltage control amp) is such that its gain is reduced with the input level of the DET circuit, and therefore with the decrease in the level of the signal applied to DET circuit (pin ⑪), VCA gain is reduced for expansion of the signal (1:2). In the process, a weighting circuit having a frequency characteristics opposite to the emphasis 2 circuit is added to the DET circuit input, so that the VCA gain is raised to offset the emphasis by the emphasis 2 circuit when a signal with high frequency components alone is applied thereto. The Lch, Rch audio signal thus de-emphasized and expanded to the original state is produced from pins ⑨ and ⑳ of IC601 and applied to pins ① and ⑫ of IC608 of the REC/PB change-over switch.

6-1-5. AFM audio circuit (PC-14B Board)

FM audio system of the 8mm video set is frequency multiplex recording which defers from stereo depth recording more simplified than β-HiFi. The specifications of this FM audio system are shown below.

(FM audio specifications)

	Spec	Remarks
Carrier frequency f_A	1.50±0.02 MHz	
Maximum frequency deviation Δf	±100 kHz	
Recording current IA/IC	−12.0±1.0 dB	Reduces chromatic signal recording current to 0 dB
Noise reduction	See related section	
Bandwidth of recording FM signal	1.50±0.15 MHz	Bandwith containing 99% (by power ratio) of whole spectrum components
Reference frequency deviation	±60 kHz	Modulation frequency 400 Hz

Table 6-6.

(Specifications of noise reduction)

The specifications of noise reduction of this system are the same as those of FM audio and PCM audio. See Fig. 6-15 and Table 6-5.

(1) Recording system

1. Input switching

Inputs of FM audio include built-in tuner, line input and mike output. Of these inputs, the signal of tuner system is exclusive to FM audio (main) and through IC502 (1/2) is applied to pin 32 of CX20137 (IC501). The LINE, AUDIO, and MIC input system, on the other hand, share an input switching circuit with the PCM audio system (See the description about PCM input switching circuit for more detail), so that the output of pins 14 and 4 of IC612 (stereo) is mixed at CP24 ((L+R)/2), and applied to pin 36 of IC501. One of these signals is selected by LINE VIDEO signal applied to pin 39 .

In the SIMUL mode, the tuner input may be used also for FM audio, and line input for PCM audio.

2. AGC

The audio signal selected at the input change-over switch is detected via VCA (voltage control amp). This detection circuit produces a DC voltage proportional to input signal. The VCA gain is controlled by this voltage to perform AGC operation. Also, the time constants of AGC (attack time and recovery time) are determined by C and R of pin 17 .

3. LPF-1 (low-pass filter)

The audio signal from VCA is divided into two branches, one applied through REC/PB change-over switch to pin 20 , and via IC502 (1/2), through Lch and Rch line output amplifier IC606 (1/2 × 2), produced to line out, etc.

The other signal is applied through REC/PB/DROP OUT change-over switch and produced from pin 1, and applied to a tertiary active LPF including buffer amps of pins 2 , 3 , R522, R521, R520, C522, C520 and C521. This LPF operates at the time of both recording and playback to cut the unnecessary bands about 25 kHz or more, thus preventing faulty trip of the noise reduction circuit.

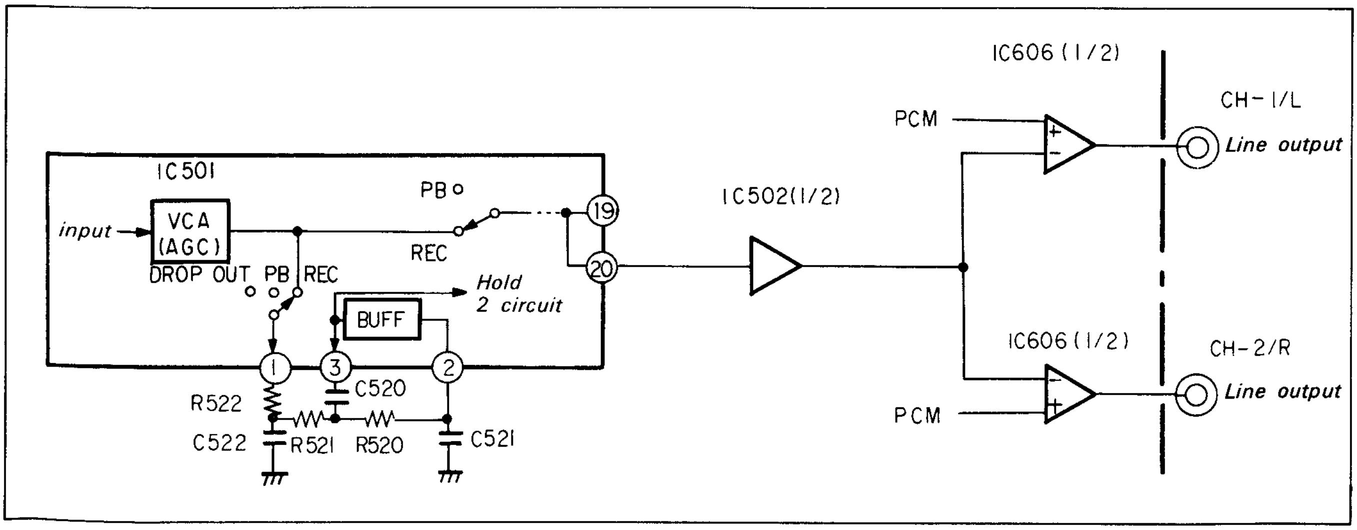


Fig. 6-22.

4. NR (Noise reduction), pre-emphasis

The audio signal from the buffer amp of LPF-1 is produced from pin ⑩ via hold 2 circuit, which does not operate during recording.

The audio signal is applied to pin ㉚ again and then to MOA (main opeartional amp) of the NR circuit. The MOA operates as an operational amp with input at pin ㉚ as a positive input, and an input at pin ㉙ as a negative input in REC mode. An audio signal with high frequency component level reduced by the emphasis circuit is fed back to the negative input of MOA, and therefore the gain of MOA is increased at the high frequency region being subjected to pre-emphasis. The gain of VCA (voltage control amp), on the other hand, is reduced with the input of the detector circuit. As a result, with the reduction of signal level, the amount of MOA feedback is reduced, so that the gain of MOA is raised to compress the audio signal 2:1. The weighting circuit, upon application thereto an audio signal of the high frequency region, raises the gain of VCA to offset the emphasis of emphasis 2 circuit. By doing so, the mount of emphasis of an audio signal including only high frequency components is reduced for an improved linearity.

On the other hand, the attack time, recovery time and hold time of the NR circuit are determined by the capacitors of pin ㉖ and pin ㉗.

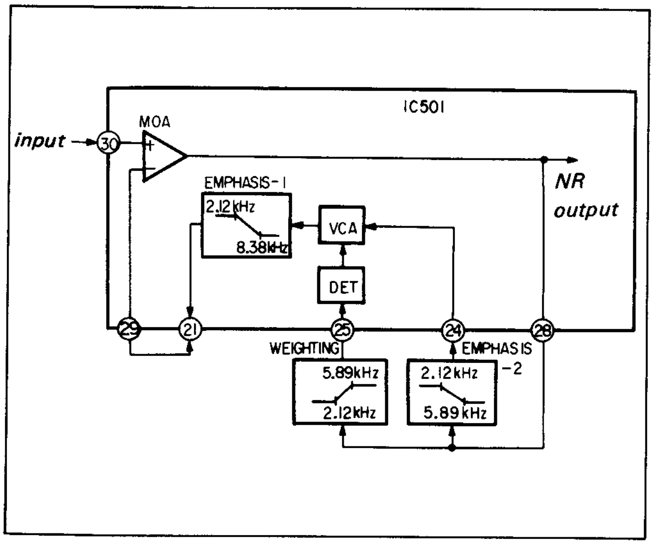


Fig. 6-23. Block diagram of NR circuit (recording)

5. Limiter

With the increase in the AFM signal, over-modulation occurs. Therefore, the level is limited by this limiter in order to prevent the picture from being interrupted.

6. VCO

The audio signal produced from the limiter is applied via REC/PB change-over switch and muting cirvuit to V → I converter where it is converted into current to produce VCO.

RV502 of pin ㊻ of IC501 controls the output current of the V-I converter in the absence of signal, and sets the carrier frequency of AFM signal at 1.5 MHz. RV501 of pin ㊳, on the other hand, controls the conversion gain of the V-I converter, and in this way, sets the frequency deviation of VCO to ±60 kHz (60%) upon application thereto of the audio signal of reference level. The AFM signal converted to FM signal at VCO is applied to pin ⑦ via the REC/PB change over switch. The AFM signal is applied through the low-pass filter of pin ⑧ of IC501, C and R, so that the recording current is adjusted at RV503, mixed with the chromatic signal, ATF signal and Y-RF signal at VI-9A board, and produced to video head through RP-25D board.

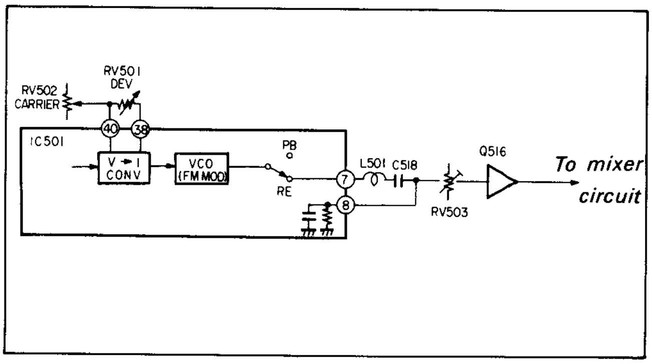


Fig. 6-24. VCO circuit

7. LP emphasis circuit

In order to improve the crosstalks in the LP mode, the emphasis characteristic is improved for recording to the extent that the compatibility of the hearing sense or level with SP.

Time constant elements C544 and R573 are inserted in parallel with a resistor determining the conversion gain of the V − I converter, thus applying greater emphasis on the high frequency region in LP mode alone. This switching is accomplished by operation Q507 and 508 with the SP/$\overline{LP}$ signal supplied from the system control.

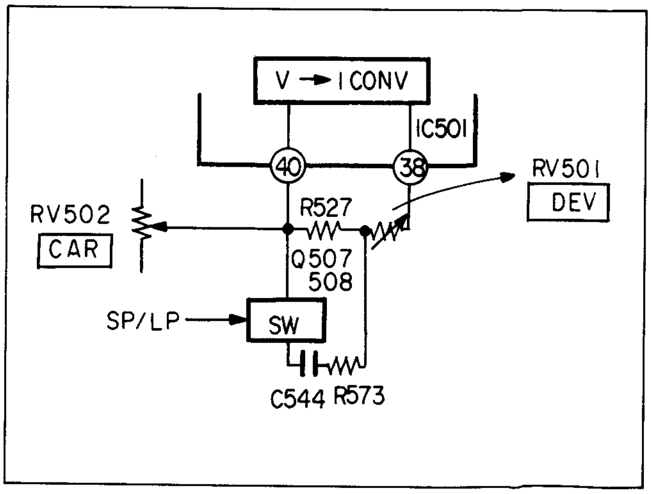


Fig. 6-25. LP emphasis circuit

(2) Playback system

1. BPF (bandpass filter)

The RF signal reproduced at the video head is amplified at RP-25D board, and through VI-9A board applied to PC-14B board. From this RF signal, AFM signal component of 1.5 MHz is separated and applied to BPF501 and pin ㊹ of IC501.

2. Playback amp, limiter, PLL FM demodulation circuit

The AFM signal applied to pin ㊹ of IC501 is amplified at a playback amp, and the AM variations thereof eliminated at a limiter circuit, followed by application to FM demodulator circuit of the PLL type.

The FM demodulator circuit is comprised of ϕCOMP (phase comparator circuit) VCO and V → I converter. ϕCOMP compares the phases of the AFM signal and the 1.5MHz signal from VCO, and produces an error voltage. This error voltage is applied via REC/PB change-over switch and V → I converter to VCO. Thus, VCO oscillates at a phase with the AFM signal phase-locked. The oscillation frequency of VCO is proportional to the voltage applied to the V → I converter, and therefore the ϕCOMP error voltage is proportional to the frequency deviation of the AFM signal. This error voltage makes up a demodulated audio signal.

3. DOC (drop-out) detecting and muting detection circuit

The AFM signal produced from the PB amp is also applied to the DOC detection circuit. This circuit detects the input AFM signal level and produces a hold signal. The hold signal is applied to Hold 1, Hold 2 and REC/PB/DROP OUT change-over switch on the one hand, and to the mute detection circuit on the other. In this circuit, the pulse width of the hold signal is detected and when the pulse width exceeds a certain time length, it produces a mute signal. A timing kchart of dropout compensation by the hold signal and mute signal is shown in Fig. 6-26.

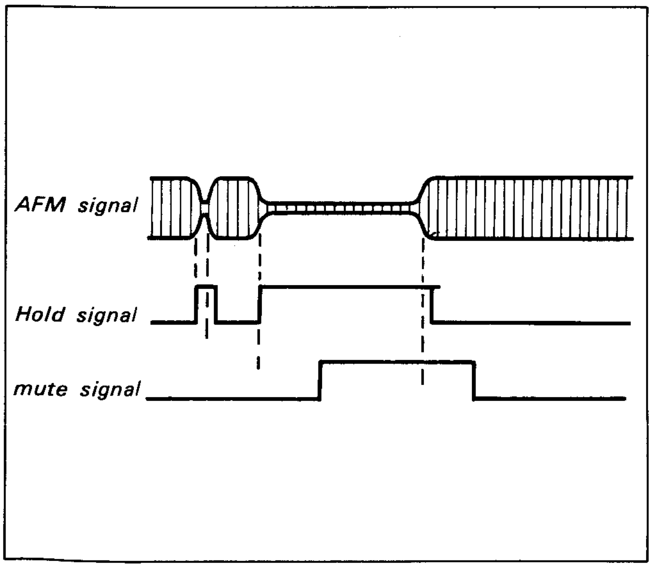


Fig. 6-26. Timing chart for dropout compensation

4. Hold 1 circuit

The audio signal from ϕCOMP (phase comparator) circuit is applied to Hold 1 circuit where the noise caused at the time of switching video head is eliminated by pre-holding. A hold pulse is generated from 50 Hz RF SW pulse produced by application to the PG doubler circuit and a mute signal of the dropout detection circuit.

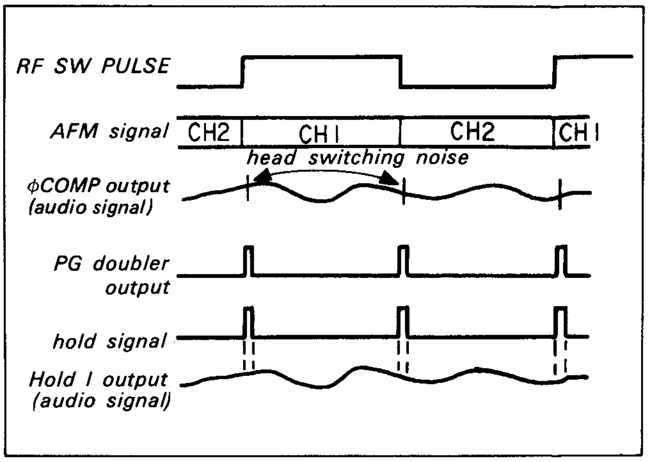


Fig. 6-27. Timing chart for head switching noise compensation

5. Dropout compensation circuit

The dropout compensatinn circuit is comprised of a REC/PB/DROP OUT change-over switch, an LPF and a Hold 2 circuit.

The audio signal produced from the Hold 1 circuit is applied via REC/PB/DROP OUT change-over switch to active LPF of pins ①, ② and ③ of IC501. This LPF cuts the high frequency regions 25 kHz or higher to prevent false trip of the NR circuit (noise reduction ckt) while at the same time functioning as a audio signal delay line. As a result, the Hold 2 circuit is supplied with a dropout noise behind the hold signal, thus eliminating the noise caused by pre-holding.

The output of the Hold 2 circuit is returned to LPF through REC/PB/DROP OUT change-over switch when the hold signal is "H". This is to precipitate the rise of LPF at the time of cancellation of dropout by maintaining the DC potential in case of dropout.

6. NR (noise reduction) circuit, de-emphasis

The audio signal produced from the Hold 2 circuit is applied to MOA by way of pin ㉚ of IC501. MOA operates simply as a buffer amp in PB mode. The block diagram for playback operation of the NR circuit is shown in Fig. 6-28. NR circuit functions of de-emphasis and signal expansion at the time of playback.

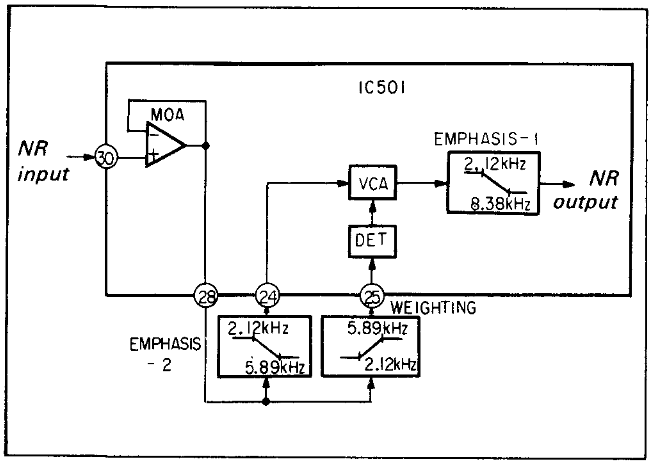


Fig. 6-28. NR (noise reduction) circuit

7. Mute circuit

The audio signal from the NR circuit is applied through REC/PB change-over switch to the mute circuit. At this mute circuit, the signal is muted by the signal from the mute detection circuit or the AFM mute signal applied to pin ⑪.
Furthermore, the signal is muted outside of CX20137 (IC501) by Q501, while at the same time reducing the gain of IC502 (1/2) by Q510. These are controlled by the AFM mule signal.
Moreover, the AFM mute signal is operated not only for muting at the time of variable speed playback but for opeation of PCM/FM audio switching.

8. Output circuit

The audio signal from the mute circuit is applied through the line output amp IC606 (shared by PCM audio system) to the AV connector as a line output signal and the phono jack as a audio output signal. At the same time, the output signal is transmitted also to the headphone circuit, level indication circuit and the RF modulator.

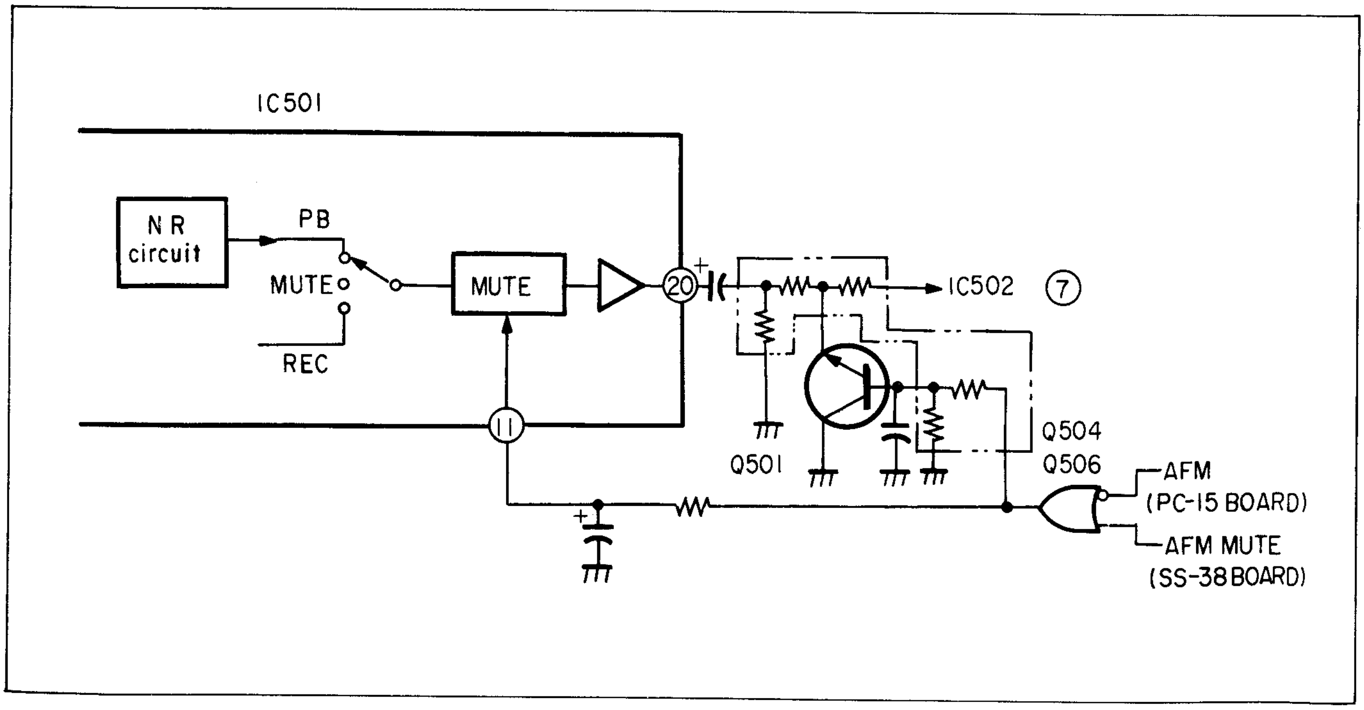


Fig. 6-29

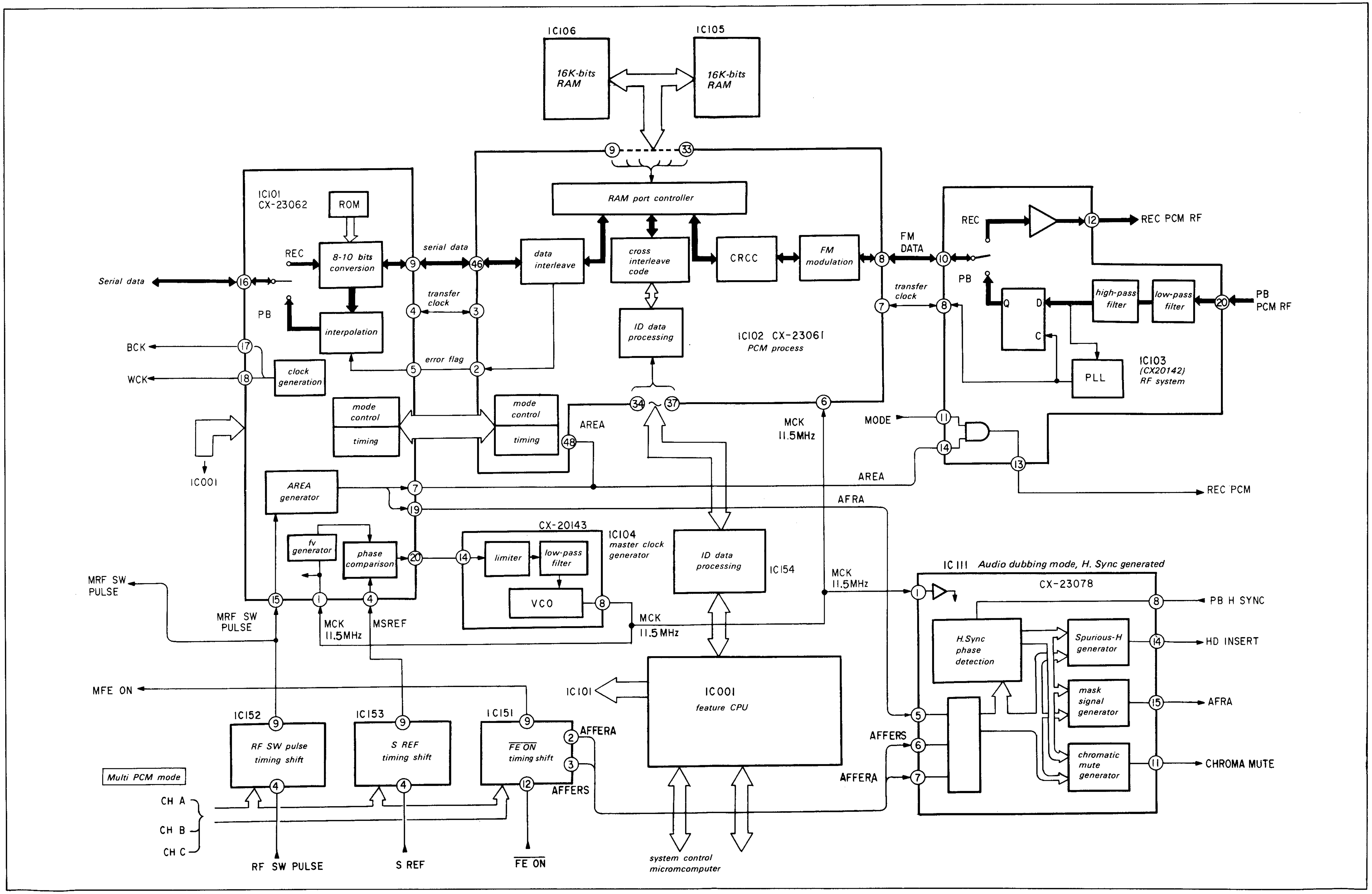


Fig. 6-30. Block diagram of PCM audio digital

6-2. DIGITAL AUDIO SYSTEM

Fig. 6-30 shows a block diagram of the PCM audio digital system of this model. The circuit compروses a clock generator (IC104) for synchronizing three ICs (IC101, 102, 103) for PCM signal processing and a PCM system, a pulse generator (IC111) for correction of played back picture at the time of audio dubbing, an ID code-processing IC (IC-154), a CPU (IC151) to 153) for multiple PCM shifting, and a feature CPU (IC001) for controlling the whole audio system.

1. Recording System

(1) 10-8 bits converter circuit

A 10 bits serial data supplied from an A/D converter is applied to pin ⑯ of IC101. This IC is for such signal processing as 10-8 bits conversion, data interpolation at the time of playback, and control and timing of the PCM system. Fig.6-31 shows an internal block diagram.

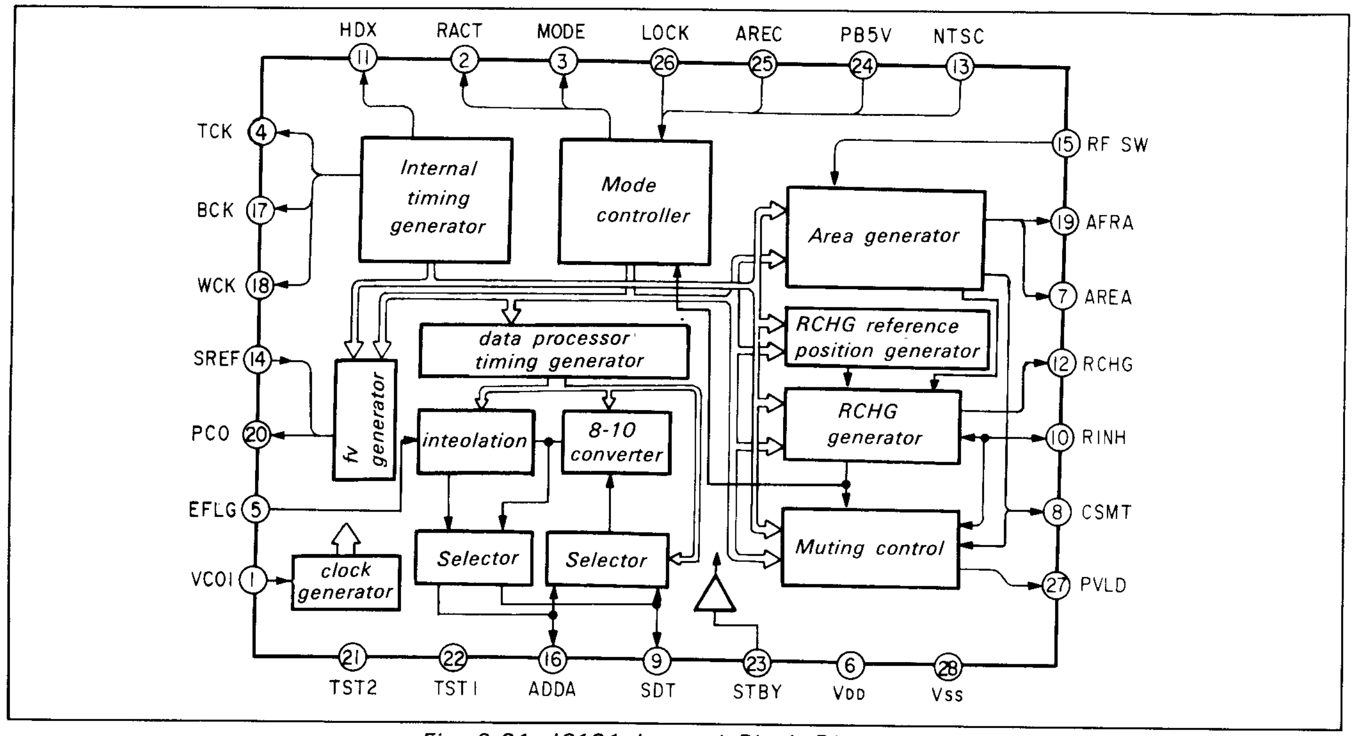
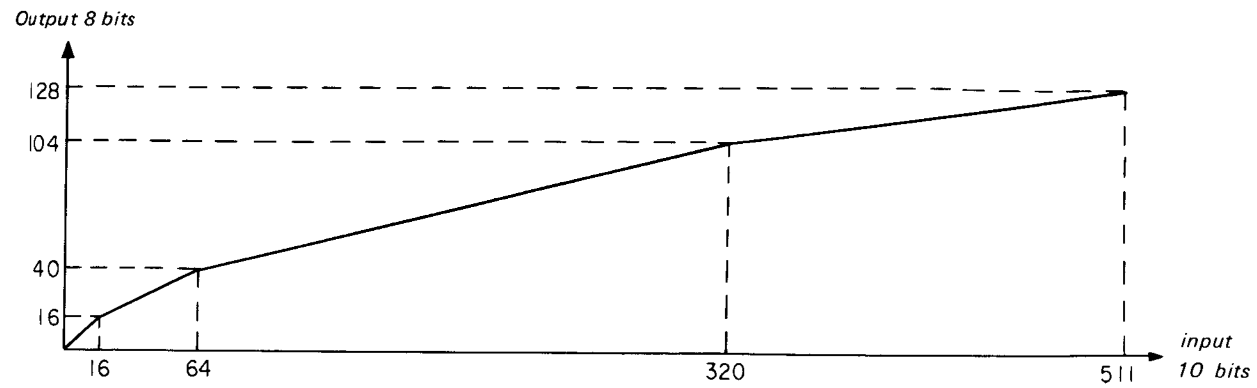


Fig. 6-31. IC101 Internal Block Diagram



(a) 10-8 bit conversion graph

Y=X	(0≦X<16)
Y=[X/2]+8	(16≦X<64)
Y=[X/4]+24	(64≦X<320)
Y=[X/8]+64	(320≦X≦511)

X: Input absolute value
Y: Output absolute value

(b) Conversion algorithm

Encode law	Input data	Output data
10bits→10bits	0—15	0—15
10bits→9bits	16—63	16—39
10bits→8bits	64—319	40—103
10bits→7bits	320—511	104—127

(c)

Fig. 6-32.

The 10-bits data applied from pin ⑯ is subject to be converted into 8-bits data. This is called the non-linear quantization (polyfonal quantization) for compressing and recording the data in order to increase the dynamic range in the recording capacity on a limited tape, and demodulating it by extending it to the original size at the time of playback. The ear of a human being has a tendency to fail to hear noises by macking when the signal level is high. This fact is used in such a manner as that shown in the conversion graph of Fig.6-32, the less significant 8 bits of the 10 bits data are directly used, while the data are progressively roughened with the rise of the level. As a result, the dynamic range as large as 10 bits is attained in spite of the small recording capacity of 8 bits.
The converted 8 bits data is produced from pin ⑨ . The clock for data transfer is provided by TCK of pin ④.

(2) Cross interleave code, CRCC, FM modulation (See Figs. 6-30, 6-33.)

The 8-bit data produced from IC101 is applied to pin ㊻ of IC102. This IC works for correction of an error. The 8 bits data is incorporated in IC102 at the fall of the transfer clock TCK (③ Pin), and after being serial-parallel converted at the data interleave block, it is written in a 16k bits RAM (IC105 or IC106) through a port controller block.

When a field of data is written, RAM is replaced with the next RAM. At the same time, ID data for identification of stereo/bilingual or the like is sent from the feature microcomputer (IC001) to IC154 (ID data processing IC), and after data exchange between pins ㉞ to ㊲ of IC102 from IC154, is serial/parallel converted at the IC data block, followed by being written in the RAM (IC105 or IC106) through the port controller block. After writing of a field of data, the encoding operation of the cross interleave code is started. The encoding operation is performed in such a way that the cross interleave block makes access to RAM via the port controller by the procedures predetermined in the 8 mm VTR PCM format and retrieves the data from RAM. At the same time, two codes, P and Q parities, are added, and sent to the CRCC (cyclic redundancy check code: A code for error detection).
At the CRCC block, the data is converted from serial to parallel for CRCC generation. An error correction code (generative multinomial) is added to the data, and FM modulated (Bi-phase-mark) at the FM modulation block, so that the data is produced from pin ⑧ in the form of 2.9 MHz for "0" and 5.8 MHz for "1".
The FM data is applied to RF-processing of IC103 ⑩ and produced from pin ⑫ to be recorded on the tape through the recording amplifier.

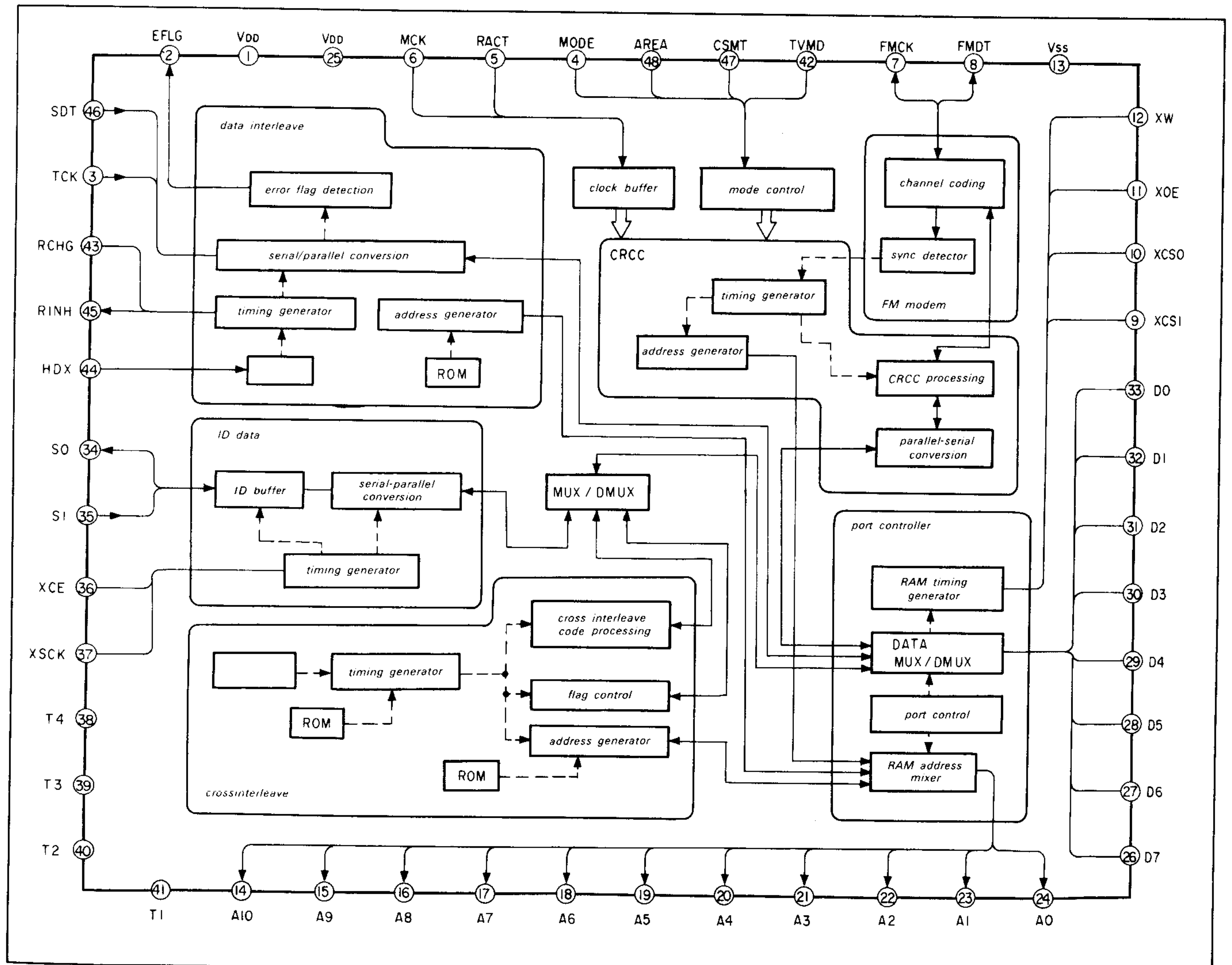


Fig. 6-33. IC102 (CX23061) block diagram

(3) Timing (See Fig. 6-34)

The IC104 (CX20143) is a master clock generator (11.5 MHz) for synchronizing the whole PCM system. The PCM system is based on a 50 Hz servo reference signal called SREF (servo referecne), and so SREF must be phase-locked with the master clock. For phase comparison in IC101 (CX23062), SREF is applied from pin ⑭ and MSK from pin ① of IC101 and compared. The comparison result is produced from pin ⑳ and applied to pin ⑭ of IC104. After being subjected to PLL, VCO is controlled, so that MSK performs SREF and phase lock. The timing for writing on the tape is generated by RF SW pulse indicating the rotary phase of the drum. The RF SW pulse applied to pin ⑮ of IC101 is sent to the area generator circuit, and actiating a monostable multi-vibrator, and produces AREA and AFRA from pins ⑦ and ⑲ respectively. This signal is used to control the write timing of the recording amplifier. The SREF and RF SW pulse must have a predetermined phase relations as shown in Fig. 6-35. If this relations fails to hold, the servo system is judged as unstable, making it impossible to transfer to REC mode.

(4) AUDIO DUB

The PCM system remains quite the same for AUDIO DUB as for recording. During the AUDIO DUB, however, the picture in PB mode while voice alone is in REC mode, and so as shown in Fig.6-36, the played back picture is disturbed by the PCM recording current and the erasing current for flying erase head.

At this part, therefore, Hsync is not obtained at all, but the AFC of TV is greatly disturbed, with the result that Hsync is spuriously produced by IC104 (CX23078) for H compensation. Against the picture disturbed, a black mask is applied.

Also, at time of AUDIO DUB, if it is in SP mode, the head width is 27μm, and track width is 34.4μm and so the recording pattern includes a guard band. Thus, at the time of AUDIO DUB, it is always necessary to erase with flying erase head. In the LP mode, however, the recording pattern is 17.2μm and covers all, and therefore there is no fear of erasing failure. So, the flying erase head is not used.

As a result, there is no effect of the erase current of the flying erase head, and requiring no black mask at the central part of the picture.

In this case, the black mask of SP is produced at intervals of a field. This is because the flying erase head operates once every two fields to erase two tracks. If the flying erase head is not used, a slight tracking displacement may cause an erasing failure.

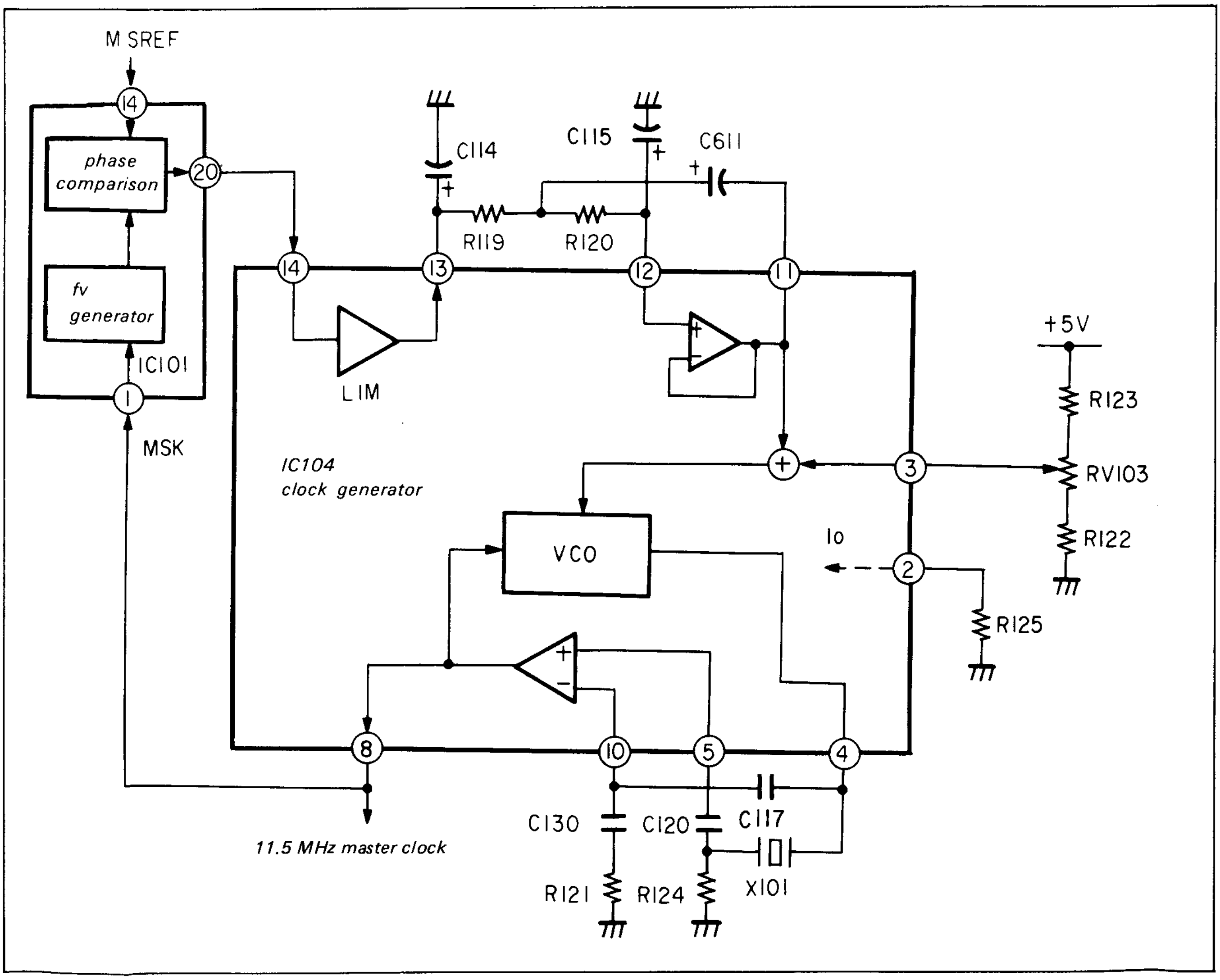


Fig. 6-34. IC104 (clock generator)

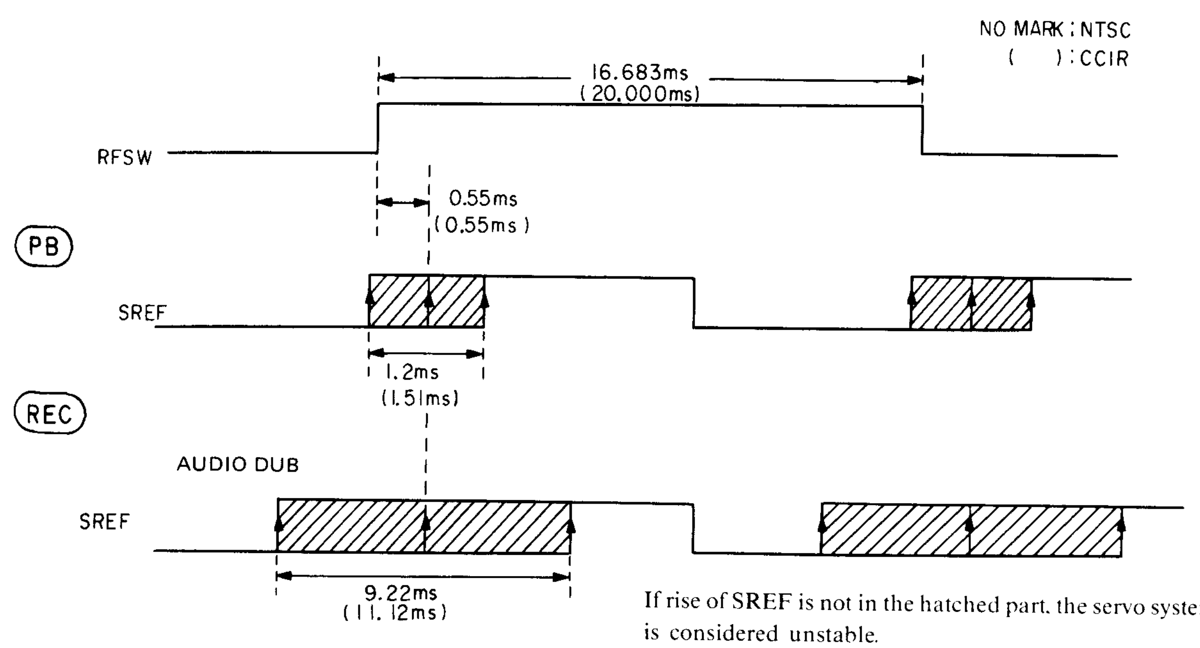
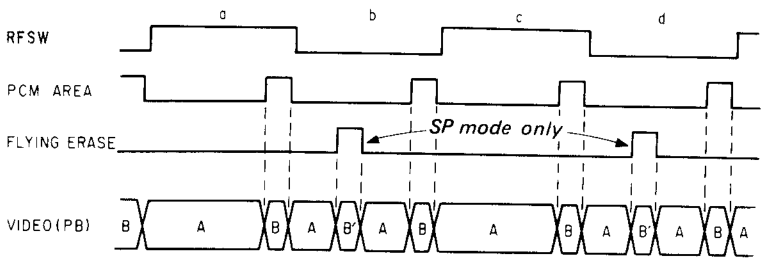


Fig. 6-35. Phase relations between RFSW and SREF

- **Timing for AUDIO DUB**

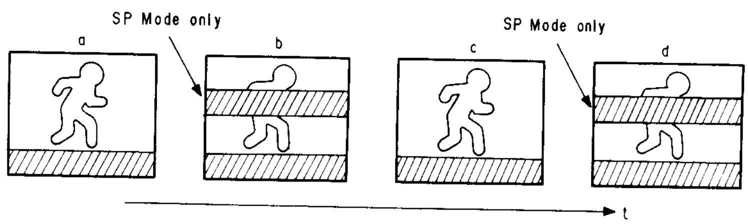


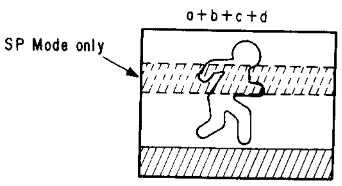
A: PB video signal (normal)

B: Part of the video signal distrubed by the PCM recording current crosstalks between rotary transformers

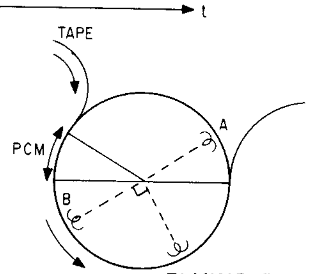
B': Part of the video signal disturbed by the flying erase head erase current crosstalks between rotary transformers (only in SP mode)

Hsync is upset at parts B and B' ⟶ AFC of TV greatly disturbed ⟶ Parts B, B' replaced by spurious Hsync.





Picture at time of AUDIO DUB



FLYING ERASE HEAD (2-track wide)

Fig. 6-36.

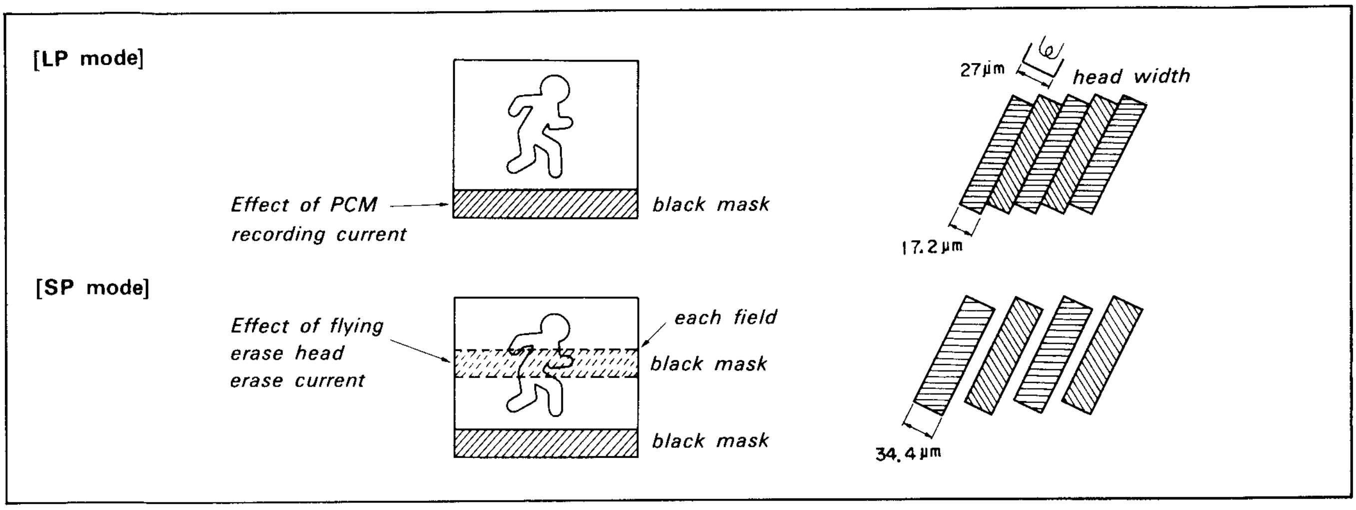


Fig. 6-37.

2. Playback System

(1) RF processing

The playback FM signal sent from the head amp is applied through Q004 buffer to the RF signal processing IC103 in Fig. 6-38. The playback FM signal of IC103 ⑰ is a comparator input for shaping the playback FM signal. The PCM error rate for playback is determined by the frequency characteristics, phase characteristics and S/N of FM signal.
As shown in Fig. 6-39, the ideal characteristic of pin ⑰ takes the form of −6 dB at 5.8 MHz for frequency and flat in phase. The playback RF signal is such that its phase is changed by the middle turning of the head amplifier at the high frequency region and contains high-frequency noises, so that the high-frequency region is cut by a low-pass filter including R108, R104, C103 and C104, while at the same time adjusting the frequency characteristics in such a manner as to attain −6 dB at 5.8 MHz by compensating for phase change at the high frequency region by means of a low-pass filter to make the phase flat. The signal is applied by way of pin ⑰, and shaped by the comparator.
The shaped signal ⓑ is divided into two groups. One is passed through the X2 circuit and takes the form ⓒ. This signal is used to control VCO to produce a clock for data detection at the time of playback, so that the playback data is detected at D flip-flop, and producing the playback FM data from pin ⑩ and a transfer clock from pin ⑧.

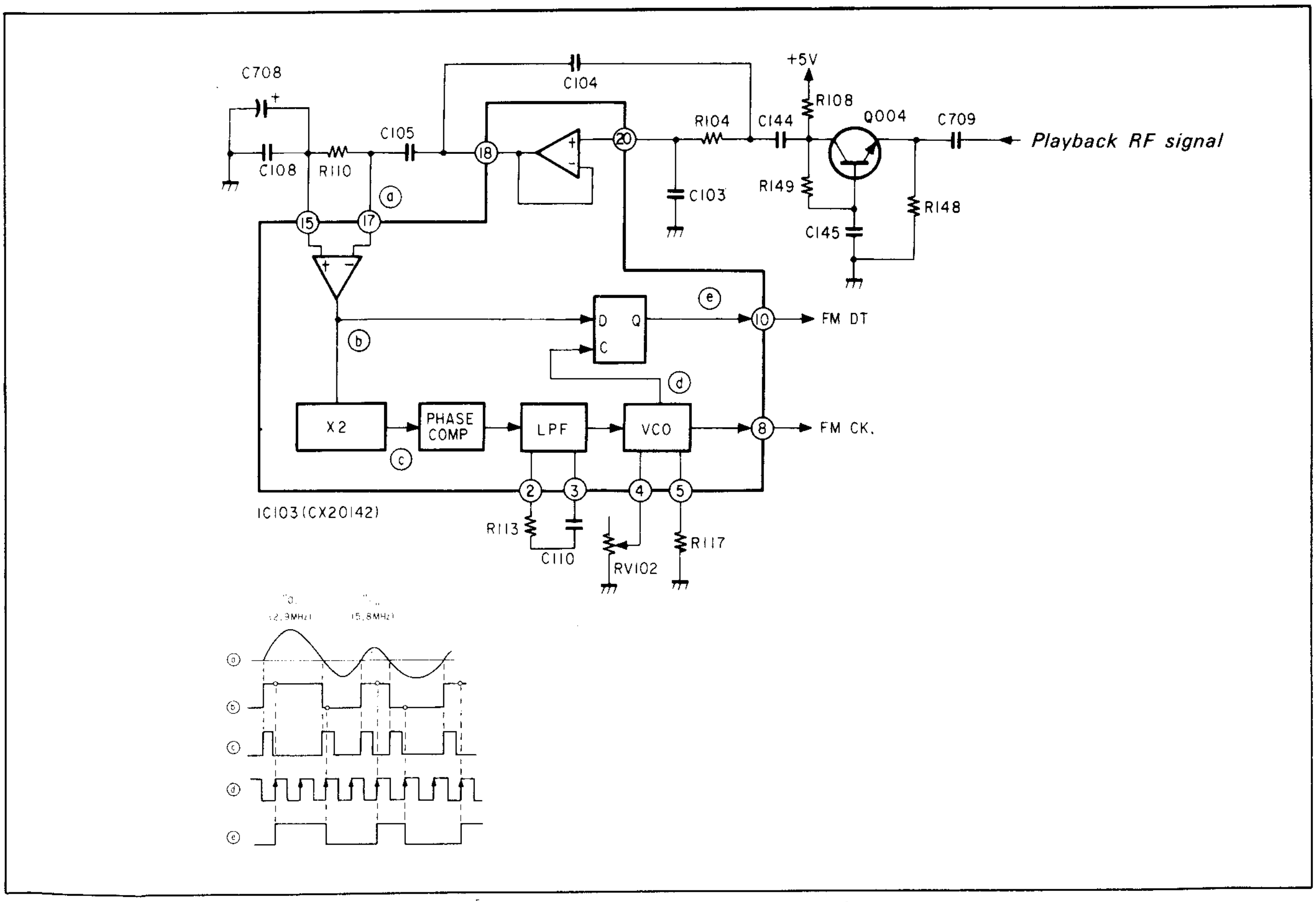


Fig. 6-38. RF signal processing IC

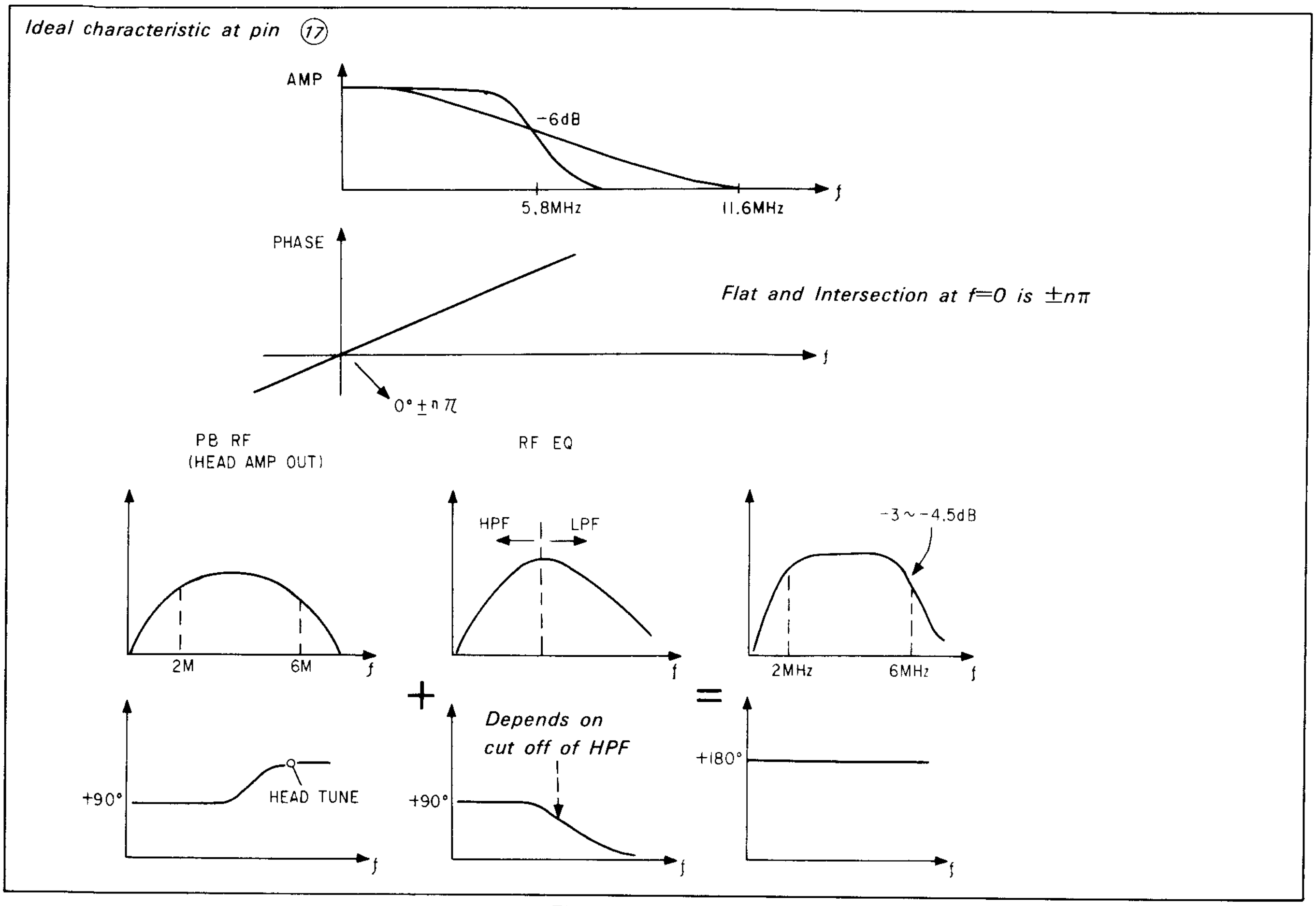


Fig. 6-39. PB EQ

(2) FM demodulation, de-interleave, error correction (See Figs. 6-30 and 6-33.)

The FM data is applied to the FM demodulation block of pin ⑧ of IC102 for demodulation. Then, an error is detected at the CRCC block of IC102, and if the decision is that there is no error, the data is subjected to serial/parallel conversion, and through the port controller block, is written in RAM (IC105 or IC106). Thereafter, the cross interleave code is decoded at the cross interleave block, and if any error is detected, it is corrected. After decoding, the signal is subjected to parallel/serial conversion at the data interleave block, and is produced as serial data from pin ㊻ . On the other hand, ID data is called by ID block of IC102 from RAM (IC105, 106), converted into serial data, applied from pin ㉞ to IC154, and read by the feature microcomputer (IC001) to be produced to each port.

(3) 8-10 bits conversion, data interpolation

The 8-bits serial data of the pin㊻ of IC102 output is applied to IC101 ⑨ for 8-to-10 bits conversion which is produced from pin ⑯ . If there are many errors beyond the error-correcting ability, EFLG (error flag) becomes "H" at pin ② of IC102. Thus the error is not corrected at IC102, but data is interpolated at IC101. (Primary and secondary interpolations) In the case of errors beyond the interpolation ability, the data is replaced by the one of the immediately preceding field (pre hold), and if it continues for 4 fields or more, muting is performed.

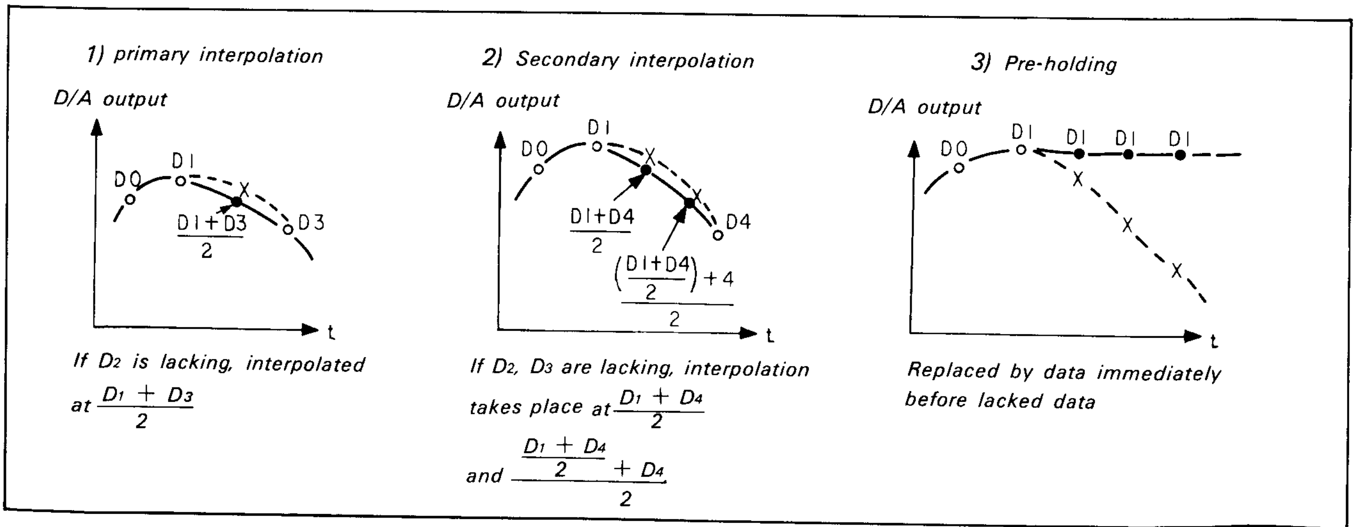


Fig. 6-40. Interpolation system

3. Multi PCM

Multi PCM is defined as a system in which the 180° portions of the video track are divided into 5 parts each of which is recorded with PCM signal to perform PCM recording of 6 channels including the old PCM track. (See Fig. 6-41.)

To realize this system, the circuit is not a special one but, in order to change the write timing on the tape, three signals including SREF, RF SW pulses, and $\overline{\text{FE ON}}$ are shifted by microcomputer (shift CPU). If additional multi PCM recording is to be mode, a pilot signal of about 230kHz called MTS for identification must be recorded, and therefore a signal generator and a detection block for playback are required for that purpose.

(1) Timing shift

In the PCM system performing the operation while maintaining a predetermined relations with RF SW pulses on the basis of SREF, the timing of these two control signals including SREF and RF SW pulses must be changed in accordance with the write area if the area for multi recording is to be changed. As shown in Fig. 6-42, the SREF and RF SW pulse for PCM are shifted by IC152, 153 for writing.

At the same time, the erasing timing for the flying erase must also be changed, and therefore $\overline{\text{FE ON}}$ signal is also shifted by IC151.

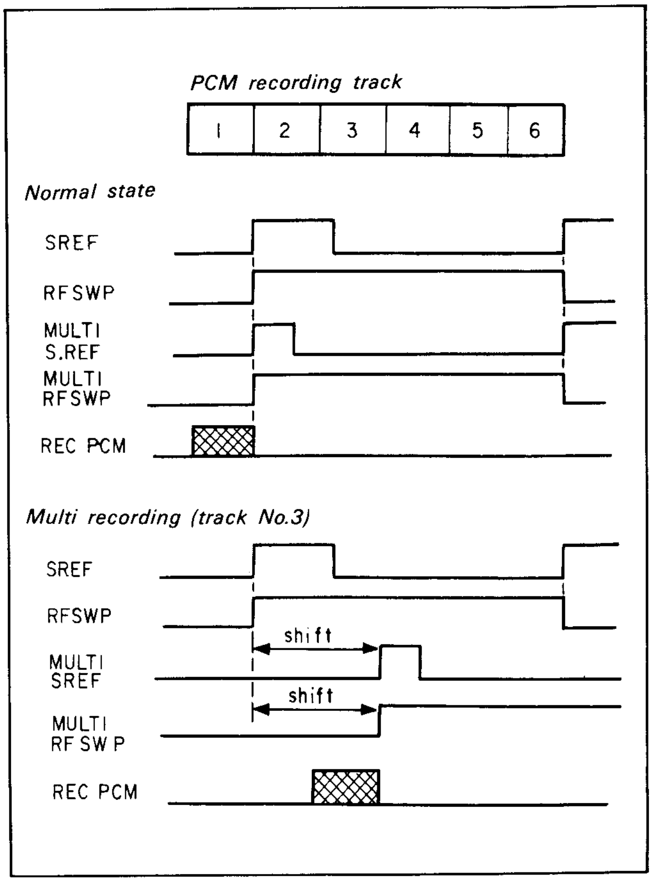


Fig. 6-42. Multi timing shift

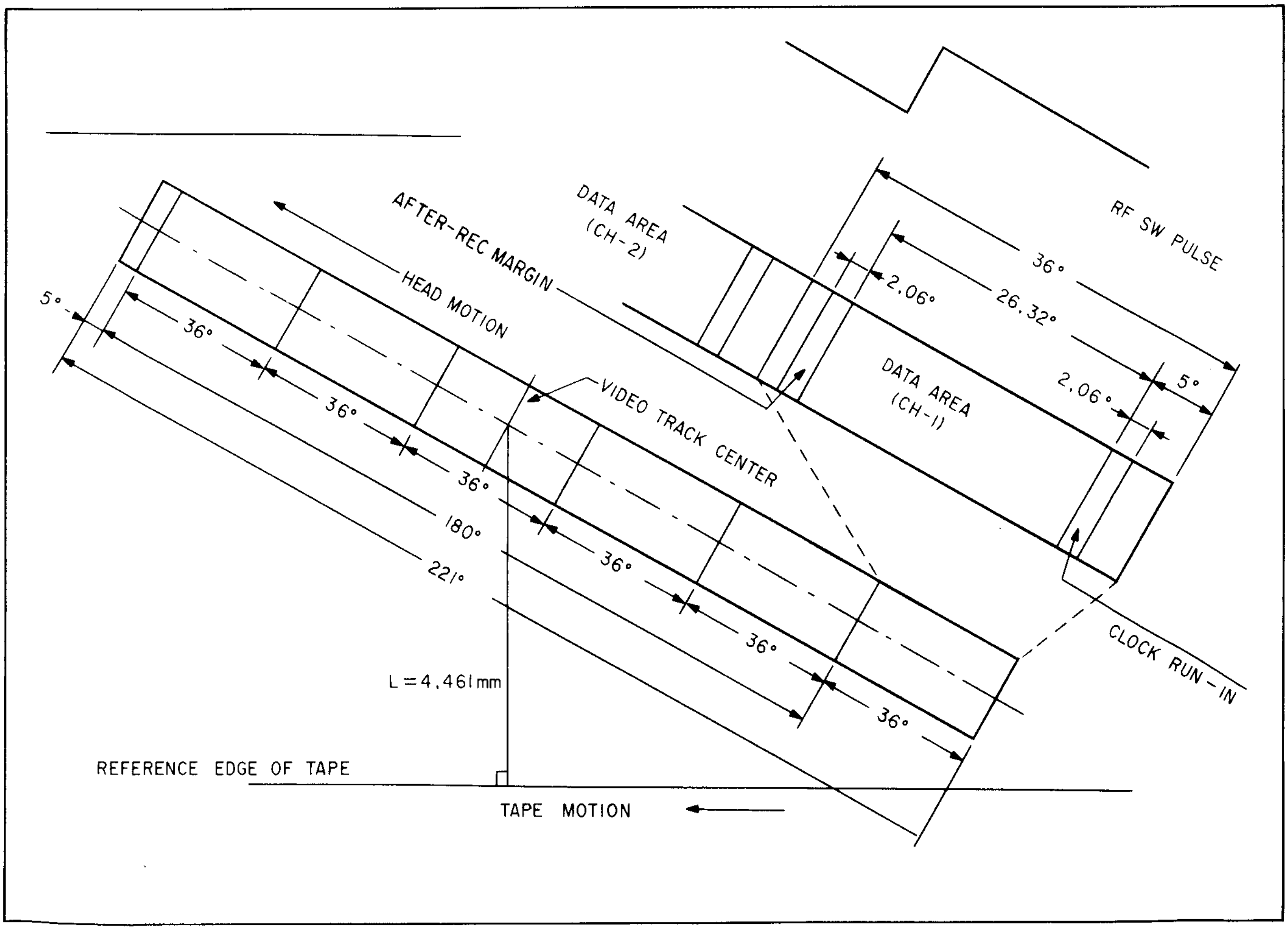


Fig. 6-41. Tape format of multi PCM

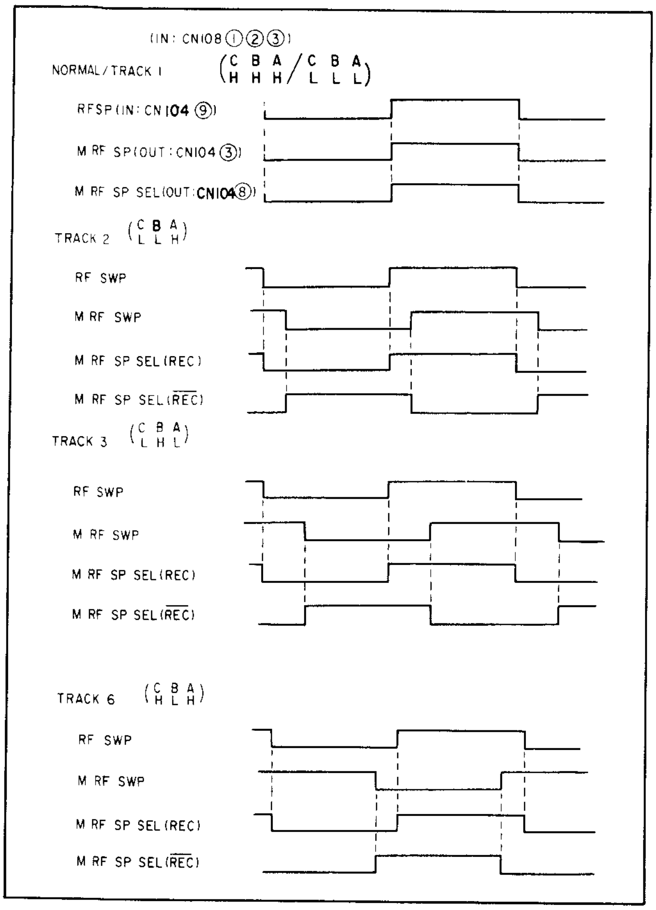


Fig. 6-43. Shift timing of multi RF SW pulse

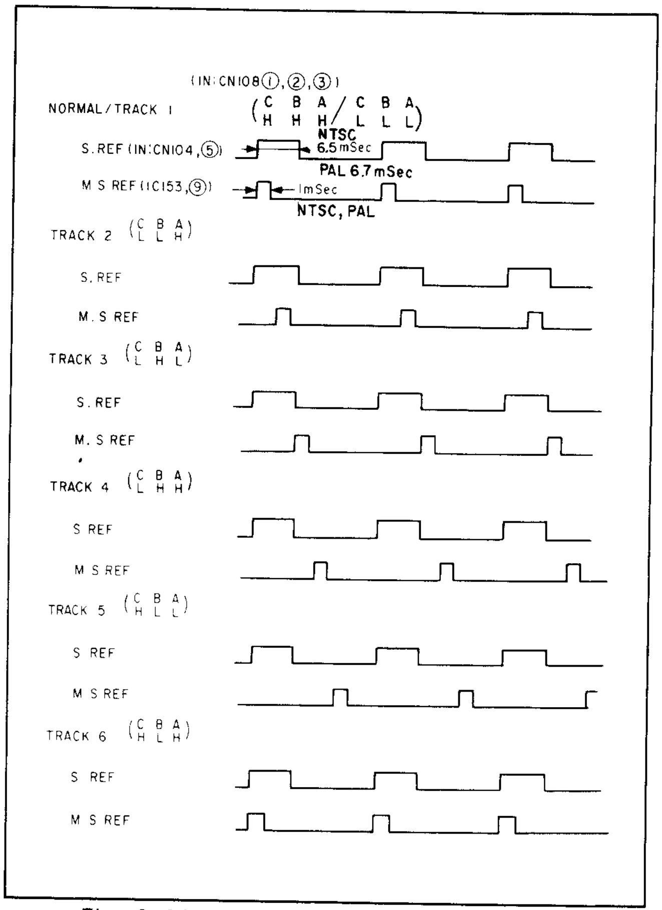


Fig. 6-44. Shift timing of multi S REF

(2) SEG EXT signal detection

At the time of multi PCM recording, a pilot signal (228.748 kHz) is recorded in superimposition on the PCM to determine whether normal recording (picture and voice) or PCM recording at the time of reproduction have been made. At the time of multi PCM recording, whether or not recording is made at 1 ch to 6 ch is displayed. Whether multi PCM is recorded or not is determined by the following mode: PB, X2, STILL, REC-PAUSE and CUE/REV. A block diagram is shown in Fig. 6-45.

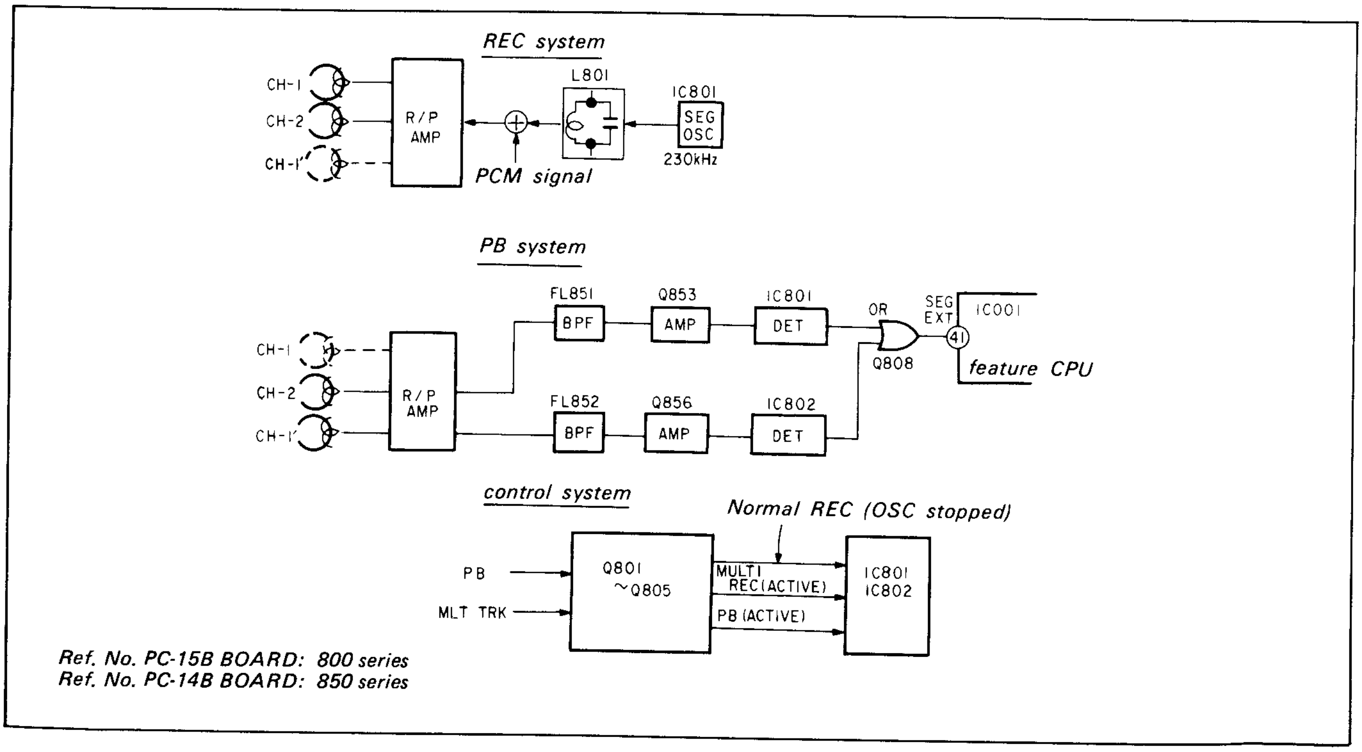
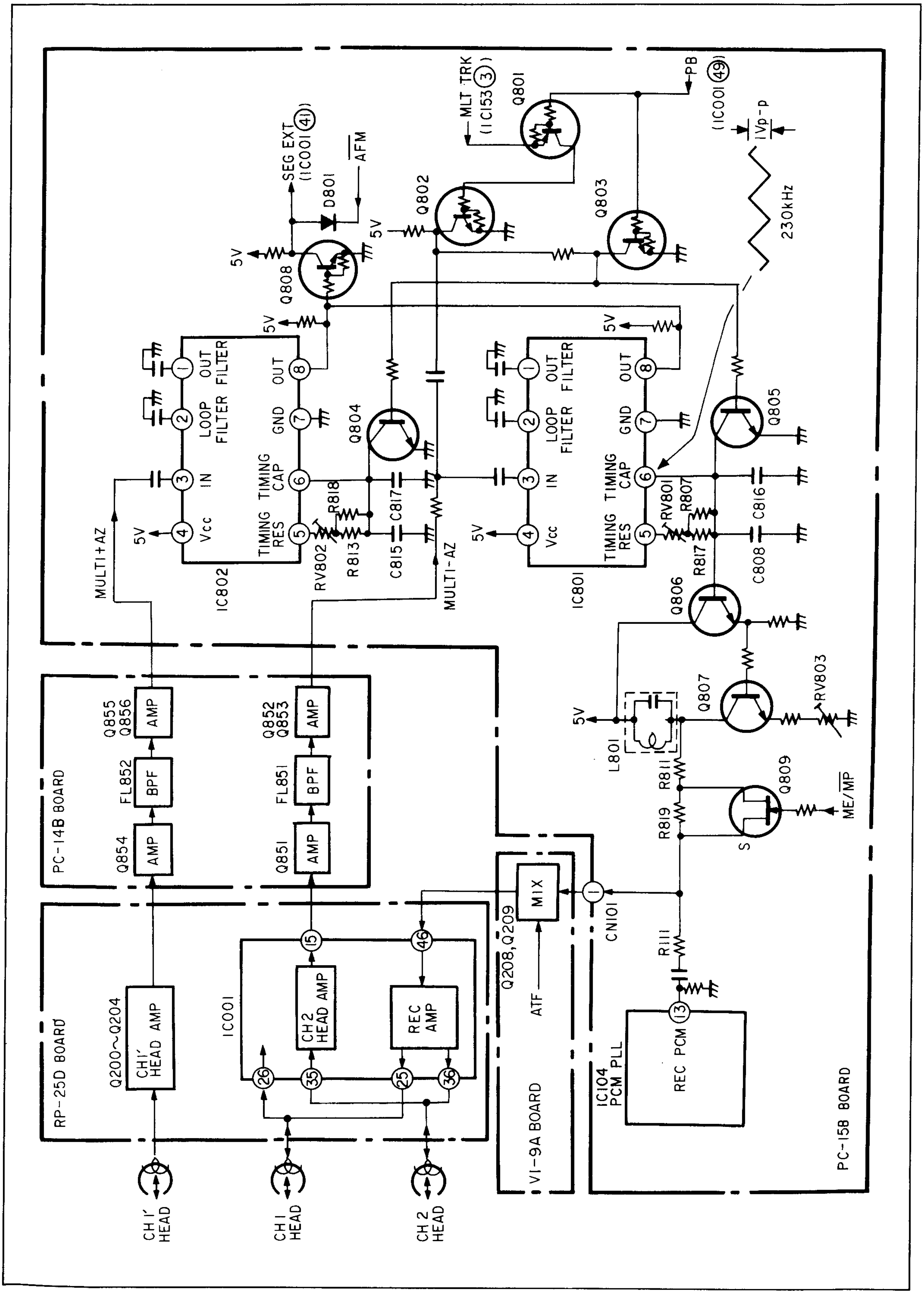


Fig. 6-45.



SEG EXT
(IC001 (41))
AFM
D801
Q808
5V
Q802
MLT TRK
(IC153 (3))
Q801
PB
(IC001 (49))
1Vp-p
Q803
230kHz
LOOP FILTER
OUT FILTER
IN
Vcc
TIMING RES
TIMING CAP
GND
OUT
IC802
IC801
RV802
R813
R818
C815
C817
Q804
MULTI+AZ
MULTI-AZ
RV801
R807
R817
C816
C808
Q805
Q806
Q807
RV803
L801
R811
R819
Q809
ME/MP
PC-14B BOARD
Q854
AMP
FL852
BPF
Q855
Q856
Q851
FL851
Q852
Q853
RP-25D BOARD
Q200~Q204
CH1' HEAD AMP
IC001
CH2 HEAD AMP
REC AMP
Q208, Q209
MIX
ATF
VI-9A BOARD
CN101
R111
IC104
PCM PLL
REC PCM
PC-15B BOARD
CH1' HEAD
CH1 HEAD
CH2 HEAD

Fig. 6-46.

[Circuit operation]

At the time of normal recording, PB (feature CPU pin (49) of IC001) is "L", and MLT TRK (shift CPU pin (3) of IC153) is "L", and so Q801, Q802 and Q803 are turned off while Q804, Q805 are turned on. IC801, IC802 are thus inhibited from oscillation. During multi PCM recording, PB is"L" and MLT TRK is "H", and so Q801, Q802 are turned on, while Q803 is turned off together with Q804, Q805, so that IC801 and IC802 become active. Furthermore, since pin (6) of IC801 is dropped to GND in AD fashion, a triangular wave free of variation is oscillated at pin (6) of IC801. This frequency is determined by RV801, R801, R817, C808 and C816 and adjusted to 230 kHz. (Same for IC802) This signal, through Q806, is applied to an LC resonance circuit L801 and making up the collector load of Q807, where the high harmonics are removed. Then through R811 and R819, it is superimposed on the PCM signal that comes from R111, and further at the VI-9Aboard, is mixed with ATF signal and applied to RP-25Dboard for recording in each multi area. In the process, it is impossible to display it on the oscilloscope because the mixer circuit input on the VI-9A board side is grounded at the base with input at emitter. By the way, the frequency of 230 kHz is determined taking PCM error into consideration after interleaving with ATF pilot. The mixing level of this SEG pilot is adjusted to −20 dB for the MP (metal powder painting) tape by RV803, and to −17 dB as Q809 is turned on for the ME (metal evaporation) tape. During PB mode, both CH-2RF and CH-1'RF sent from the RP-25D board, that is, both the heads of the double azimuth head are used for detection of SEG RF signal. CH-2 RF is amplified at Q851 of PC-14B board, and the 230kHz component thereof is extracted at FL-851, and through the buffer of Q852, amplified by Q853. The signal is then sent to the PC-15B board IC801 (same for CH-1').

Since the general gain is controlled by Q853, Q852 functions also to compensate for the temperature thereof. Figures involved are 32 dB for CH-2, and 24 dB for CH-1'. These RFs are applied to the PC-15B board pin (3) of IC801 and IC802 (PLL input) respectively. At this time, regardless of "L" or "H" of MLT TRK, PB is "H" and so Q801 and Q802 are turned off, while Q803 is turned on, with the result that Q804 and Q805 are turned off, while IC801 and 802 are active and capable of receiving input from pin (3). Pin (8) of IC801 and IC802 is reduced to "L" if the signal applied to pin (3) deviates from f0 of internal VCO not more than several % (f0 adjusted by RV801 and RV802). The output from pin (8) of IC801 and 802 is subjected to wired OR, reversed at Q808, and applied to pin (41) of feature CPU (IC001). At the feature CPU, from the phase relations with RF SW pulse, the presence or absence of SFG RF signal is determined for each of multi PCM 1ch to 6ch. The reason why ch2 and ch1 of double azimuth head is used at the time of detection of SEG RF signal will be explained. In multi PCM recording, each track is recorded at random, and so the tracks are not aligned. Also, SP and LP modes may exist at the same time, and detection is required also at CUE/REV. The azimuth loss detection of either head is corrected by the opposite azimuth head. Feature CPU (IC001) reads each multi area thrice and decides as "H" if "H" is twice or more, and only if more than half of 16 feames are "H", display is mode. The identification of multi PCM therefore requires the time of 16 + 16/2 = 24 frames at maximum. At position AFM of the audio monitor switch, on the other hand, D801 drops the Q808 collector to "L", and so the forced normal mode develops during PB.

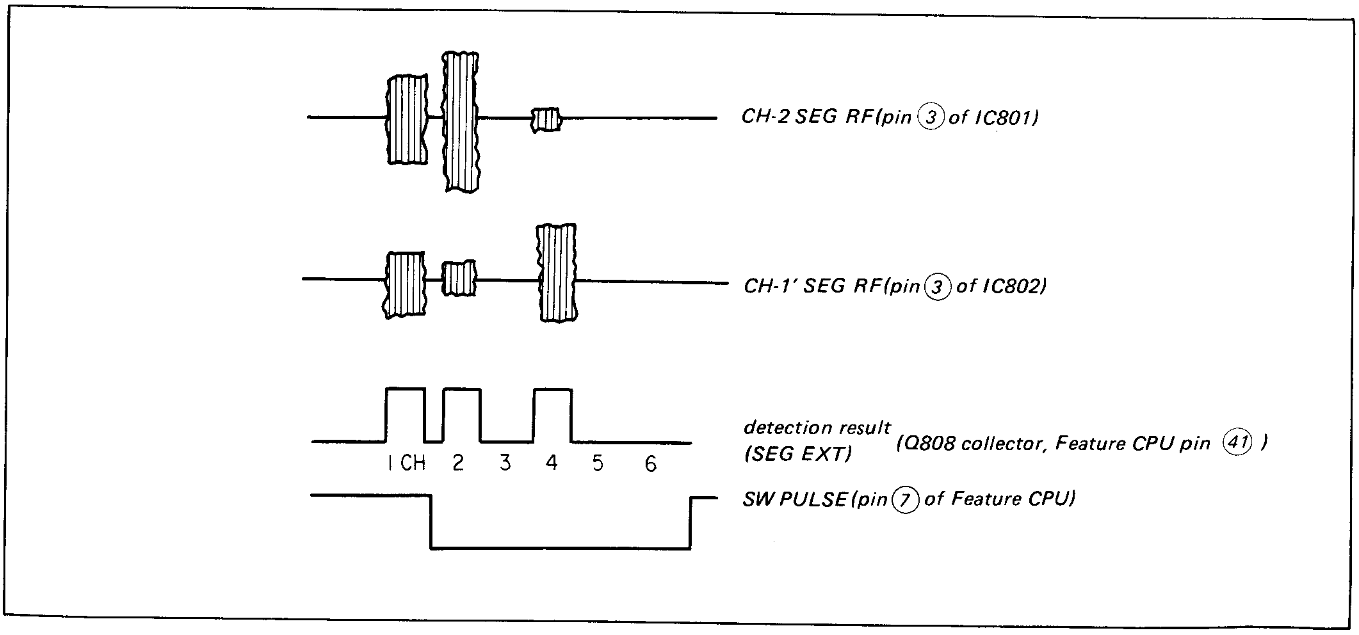


Fig. 6-47.

4. Description of main IC functions

(1) PCM Process IC (PC-15B board IC102, CX23061)

Discription of Terminal Functions

Terminal No.	Item	I/O	Function
1	VDD		Power terminal
2	EFLG	O	Error flag is produced indicating that error correction on SDT (pin 46 output PCM data) was impossible at the time of PB. Connected to pin 5 of EFLG terminal of IC101 (CX23062). AT IC101 (CX23062), data interpolation is effected at the concealment (error covering) circuit if EFLG is "H".
3	TCK	I	Input terminal for SDT (pin 46 input/output PCM data) transfer clock. Connected to TCK terminal (pin 4) of IC101 (CX23062).
4	MODE	I	Input terminal for REC/PB status signal. Connected to mode terminal (pin 3) of IC101 (CS23062). "L" and "H" applied during REC and PB respectively.
5	RACT	I	IC102 (CX23061) enable signal input terminal (active). Connected to RACT terminal (pin 2) of IC101 (CX23062). Internal state is initialized at "L".
6	MCK	I	IC102 (CX23062) master clock input terminal. During REC, it becomes also a channel coding data transfer clock. Impressed with clock stable in frequency accuracy with duty factor 1:2 or less. CCIR 11.50MHz 736fH
7	FMCK	I/O	Channel coding data transfer clock input/output terminal. During REC, produces 736 fH clock. During playback, clock of duty factor 1:1 or less sync with playback data is applied.
8	FMDT	I/O	Channel coding data input/output terminal. Impressed with or produces data while area terminal (pin 48) is "H". If area terminal becomes "L" during recording, FMDT terminal becomes Hi-Z.
9	XCS1	O	Chip selector control output terminal for two 16K bit RAMs (IC105 and IC106)
10	XCS0	O	
11	XOE	O	16K bit RAM (IC105 and IC106) output control terminal
12	XW	O	16K bit RAM (IC105 and IC106) write pulse output terminal
14 to 24	A10 to A0	O	16K bit RAM (IC105 and IC106) address output terminal A10 is the most significant bit (MSB), and A0 the least significant bit (LSB)
25	VDD		Power terminal
26 to 33	D7 to D0	I/O	16K bit RAM (IC105 and IC106) data bus terminal D7 is MSB, and D0 LSB
34	SO	O	ID data output terminal. Effective if XCE (terminal pin 30) is "L" in PB mode. Otherwise, this terminal keeps High-Z. ID data are produced in ascending order from LSB (ID0 to ID5) to LSB for each word at the timing of XSCK signal (pin 37). If an error is detected in ID workd, all bits "0" are produced.
35	SI	I/O	ID data input terminal. Effective if SCE terminal (pin 36) is 'L' in REC mode. ID data is applied from MLSB to MSB (ID0 to ID5) for each word at the timing of SCK signal (pin 37).
36	XCE	I/O	ID data transfer enable signal input terminal. Becomes "L" when ID data is made accessible to other IC.
37	XSCK	I/O	ID data transfer clock input terminal. When ID data is applied or produced, 48 clocks are applied duringthe period when XCE terminal (pin 36) is "L".
38 to 41	T4 to T1	I	Chip test mode setting terminal. Normally fixed at "L".

Table 6-7(1).

Terminal No.	Item	I/O	Function
42	NTSC	I	CCIR at "L"
43	RCHG	I	Switching signal input terminal for two 16K bit RAMs. Connected to RCHG terminal (pin ⑫) of IC101 (CX23062). Switched in sync with rise of HDX signal (pin ㊹) of every field.
44	HDX	I	4 fH input terminal Applied to HDX terminal (pin ⑪) of IC101 (CX23062).
46	SDT	I/O	Terminal for 8 bits PCM data serial transfer with IC101 (CX23062). Connected to SDT terminal (pin ⑨) of IC101 (CX23062). Input mode for recording, and output mode for playback. Data are transferred from LSB in ascending order.
45	RINH	I/O	Connected to RINH terminal (pin ⑩) of IC101 (CX23062). • Enters input mode during recording to control write inhibition RAM. When the disturbance of RCHG signal is detected at IC101 (CX23062), RINH signal is made "H" in sync with the rise of the HDX signal. During this "H" period, IC102(CX23061)does not write data in RAM (IC105 and IC106). • During PB, output mode is entered to give order of field concealment (covering of error field) to IC101 (CX23062). If the result of CRCC check shows that 44 or less OKs are given during a field, "H" is produced. At the same time, RAM (IC105 or IC106) is initialized. (Data are made all "0", and all flags "1") This signal remains effective while area signal (pin ㊽) is "L".
47	CSMT	I/O	Connected to CSMT terminal (pin ⑧) of IC101 (CX23062). • PB Impressed with CRCC start signal in input mode. If the rise of CSMT signal is detected when area signal is "H", CRCC processing is started, and the recording data is transferred through the channel coding encoder Until the CSMT signal rises, amble signal is transferred. • Playback The output mode is entered, and a muting signal is produced. If successful results of CRCC check are not more than twice in a field, "H" is produced. At the same time, RAM (IC105 or IC106) is initialized.
48	AREA	I	PCM area signal input terminal, connected to area terminal (pin ⑦) of IC101 (CX23062).

Table 6-7(2).

(2) PCM Process IC (PC-15B board IC101: CX23061)

Description of Terminal Functions

Terminal No.	Item	I/O	Function
1	VCOI	I	Clock input terminal. Main clocks for whole system: NTSC 11.580 MHz (736×262.5×fv) CCIR 11.500 MHz (736×312.5×fv) Both NTSC and PAL must be accurately locked to drum r.p.m (=**1/2** × vertical sync frequency). If not, field concealment (error field covering) will be performed regularly.
2	RACT	O	Start/stop control output for IC102 (CX23061). Started at "H". Lock signal (pin 26) received at change point of RF SW signal (pin 15), activating IC102 (CX23062) at "H".
3	MODE	O	REC/PB control signal output for whole PCM system. "H" indicates PB mode. This signal is used or sync with this signal is required for REC/PB switching of each block in the PCM system.
4	TCK	O	SDT (pin 9 input/output PCM data) transfer clock output terminal. Connected to TCK terminal (pin 3) of IC102 (CX23061).
5	EFLG	I	Input effective only during PB. If error correction trial of IC102 (CX23062) shows that the error is uncorrectable, "H" is produced in sync with data. In response, primary or secondary interpolation or preholding is performed at the concealment (error covering) circuit in IC101 (CX23062).
6	V_{DD}		
7	AREA	O	PCM AREA signal. During recording, indicates the position to write PCM signal (pre-amble signal + data + post-amble signal) and during playback, the position of playback.
8	CSMT	I/O	Function is different for REC and PB. Input/output switching is synchronized with the change of mode terminal (pin 3). • PB (I) If CRC processing at IC102 (CX2361) shows that it is necessary to mute, "H" is produced. In response, IC101 (CX23062) prohibits the reversal of RCHG output (pin 12) while fixing to "0" the output to D/A converter. The receiving timing is the same as for RINH. • REC (O) The timing of starting to write data block in PCM area is produced at "H". At the time of transfer from STOP to REC or from PB to REC mode, "L" is produced until data to be recorded is prepared.
9	SDT	I/O	A terminal for 8 bits serial data transfer with IC102 (CX23061). Transferred from LSB in the form of 2's complement. Switching input/output is synchronized with MODE terminal.
10	RINH	I/O	Functions are different for REC and PB. The input/output switching is synchronized with the change of MODE terminal (pin 3). • PB (I) If the CRC processing at IC102 (CX23061) shows that field concealment (covering of error field) is necessary, "H" is produced, and in response, the reversal of RCHG output (pin 12) is prohibited at IC101 (CX23062). The timing of receiving RINH signal is taken at the change point of RCHG signal or the point that should be a change point. • REC (O) A signal for prohibiting the writing of A/D data in 16k bits RAM (IC105, IC106). This is a process for minimizing of noise generated by field concealment at the time of recording.

Table 6-8(1).

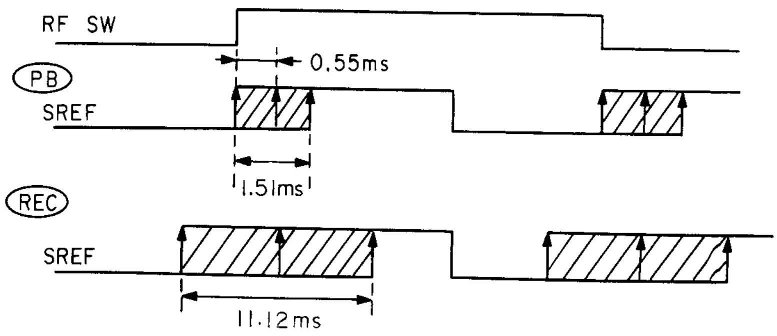
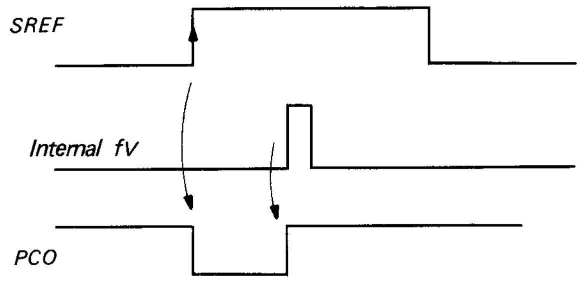
Terminal No.	Item	I/O	Function
11	HDX	O	A timing clock for transfer of data with IC102 (CX23061).
12	RCHG	O	An ouput signal indicating which of the two 16k bits RAMs is to be used for error correction or TBC at IC102 (CX23061). Normally, reversed at every 1250 words. (25.00 Hz) In IC101 (CX23062), the phase relations between the change points of RCHG output and RFSW are monitored, and when exceed a tolerance, it is recognized as an out-of-phase lock of the servo system or PLL of clock signal of VCOI (pin ①) input, followed by transfer to the field concealment mode to prohibit reversal of RCHG output.
13	NTSC	I	NTSC mode at "H" (fv = 59.94 Hz), and CCIR mode at "L" (fv = 50.00 Hz)
14	SREF	I	Input terminal for the timing signal providing a reference of PCM system. CCIR .... 50.00Hz The rise of SREF signal must be in hatched portions in the drawing against the change point of RFSW signal (pin ⑮). The fall ofSREF signal, on the other hand, is always free of care. 
15	RF SW	I	Input terminal for a signal indicating the drum rotational phase (RF SW pulse) CCIR .... 25.00Hz, duty factor 50% AREA signal (pin ⑦) and AFRA signal (pin ⑲) are produced by activating a monostable multivibrator from the change point of this signal. If the drum lock phase is displaced in the drum servo system, therefore, the recording and playback are made at the standard position on tape. PCM system always monitors the phase relations between SREF signal (pin ⑭) and RF SW signal, and if they are not in a predetermined range of phase relations, it is recognized as an out-of-phase lock of the servo system, so that the transfer from REC to PB and from PB to REC are postponed.
16	A/D-D/A	I/O	Terminal for transfer of 10-bit serial data with A/D-D/A converter. Produced and received from LSB in the form of 2's complement. Switching of input/output is synchronized with MODE terminal.
17	BCK	O	Timing clock for data transfer with A/D-D/A converter. 46fH
18	WCK	I/O	Timing clock for data transfer with A/D-D/A converter. 2fH
19	AFRA	O	Output only at time of AUDIO DUB. A switching signal for the video circuit system to eliminate crosstalk noises at the time of AUDIO DUB.

Table 6-8(2).

<table>
<tr><th>Terminal No.</th><th>Item</th><th>I/O</th><th>Function</th></tr>
<tr><td>20</td><td>PCO</td><td>O</td><td>Terminal for phase comparison between fv (50.00Hz) obtained by frequency division of VCOI input (pin ①) and SREF signal (pin ⑭).


Internal fv Rise of SREF and that of PCO are synchronized.</td></tr>
<tr><td>21</td><td>TST 1</td><td>I</td><td rowspan="2">Test mode. Normally fixed at "L"</td></tr>
<tr><td>22</td><td>TST 2</td><td>I</td></tr>
<tr><td>23</td><td>STBY</td><td>O</td><td>Terminal for initializing the whole PCM system and power safe mode At "L", all internal flip-flops are cleared to hold all output terminals initialized.</td></tr>
<tr><td>24</td><td>PB 5V</td><td>O</td><td>REC/PB switching signal. PB at "H" and REC at "L".</td></tr>
<tr><td>25</td><td>A REC</td><td>I</td><td>Control signal for AUDIO DUB. AUDIO DUB mode at "H", and normal mode at "L".
<table>
<tr><th>PB 5V</th><th>A REC</th><th>PCM mode</th></tr>
<tr><td>H</td><td>L</td><td>PB</td></tr>
<tr><td>L</td><td>L</td><td>REC</td></tr>
<tr><td>H</td><td>H</td><td rowspan="2">AUDIO DUB</td></tr>
<tr><td>L</td><td>H</td></tr>
</table></td></tr>
<tr><td>26</td><td>LOCK</td><td>I</td><td>Terminal for designating start or stop of PCM system. Stop at "L", and all functions are activated to start operation at "H".</td></tr>
<tr><td>27</td><td>PVLD</td><td>O</td><td>Terminal indicating whether PCM data is written on tape. Effective only during PB. "H" indicates that PCM data is written in a particular field. One change point occurs for each field and is synchronized with the change point of RCHG output (pin ⑫) or a point where the change is to occur.</td></tr>
</table>

Table 6-8(3).

(3) Feature CPU (PC-15 board IC001: MB88421-183M)

Description of terminal functions

Pin	Display	I/O	Function · Operation	Connection
1	IDCLK	O	Clock output for transfer of serial data with PCM ID CPU	PCM ID CPU (IC154)
2	IDRECD	O	Output data for transfer of serial data with PCM ID CPU	PCM ID CPU (IC154)
3	$\overline{\text{IDENA}}$	O	Servo lock output making up control output for transfer of serial data with PCM ID CPU	PCM ID CPU (IC514)
4	MAC	O	Acknowledge output for transfer request making up control output for transfer of serial data with system control CPU.	SS-38F/G board system control CPU (IC101)
5	FACK	I	Data receiving input making up control output for data transfer with timer CPU	FT-3C/D board subtimer CPU (IC002)
6	RQTSF	I	Data transfer request input making up control input for transfer of serial data with system control CPU	SS-38F/G board system control CPU (IC101)
7	RFSP	I	RF SW pulse input	
8	MULTI	I	MULTI/NORMAL input "H": Multi PCM mode "L": Normal mode	Shift CPU (IC151 to 153)
9	ID PBD	I	Input data for transfer of serial data with PCM ID CPU	PCM ID CPU (IC154)
10	NC			
11	REEP (Reference Pulse)	I	Input for synchroniation with control output of system control CPU	SS-38F/G board system control CPU (IC101)
12	$\overline{\text{S PAUSE}}$	I	"L" in playback pause mode, and "H" in other modes	SS-38F/G board system control CPU (IC101)
13	VMAM (Video Mute At Multi PCM)	O	Video mute output during multi PCM tape playback	
14	NC			
15	$\overline{\text{STEP}}$	O	Step operation output, "L" at time of step operation	
16	NC			
17	$\overline{\text{MAIN}}$	I	MAIN/SUB/MAIN SUB change-over switch input of audio monitor of front panel	FT-3A board S020
18	$\overline{\text{M • S}}$	I		

Indication \ Input	$\overline{\text{MAIN}}$	$\overline{\text{M · S}}$
Main	L	H
Sub	H	H
Main/sub	H	L

Table 6-9(1).

<table>
<tr><th>Pin</th><th>Display</th><th>I/O</th><th>Function・Operation</th><th>Connection</th></tr>
<tr><td>19</td><td>$\overline{\mathrm{PCM}}$</td><td>I</td><td rowspan="2">PCM/MIX/AFM changeover switch input for audio monitor switch of front panel
<table><tr><th>Input / Indication</th><th>$\overline{\mathrm{PCM}}$</th><th>$\overline{\mathrm{AFM}}$</th></tr><tr><td>(Auto) PCM</td><td>L</td><td>H</td></tr><tr><td>Mix</td><td>H</td><td>H</td></tr><tr><td>Standard (AFM)</td><td>H</td><td>L</td></tr></table></td><td rowspan="2">FT-3C/D board S021</td></tr>
<tr><td>20</td><td>$\overline{\mathrm{AFM}}$</td><td>I</td></tr>
<tr><td>21</td><td>NC</td><td></td><td></td><td></td></tr>
<tr><td>22</td><td>NC</td><td></td><td></td><td></td></tr>
<tr><td>23</td><td>NC</td><td></td><td></td><td></td></tr>
<tr><td>24</td><td>NC</td><td></td><td></td><td></td></tr>
<tr><td>25</td><td>EX</td><td>I</td><td rowspan="2">System clock</td><td rowspan="2"></td></tr>
<tr><td>26</td><td>X</td><td>O</td></tr>
<tr><td>27</td><td>$\overline{\mathrm{RESET}}$</td><td>I</td><td>Reset input</td><td></td></tr>
<tr><td>28</td><td>IRQ</td><td>I</td><td>Interruption input, applied by logic sum of RFSWP and RQTSF</td><td></td></tr>
<tr><td>29</td><td>$\overline{\mathrm{NC}}$</td><td></td><td></td><td></td></tr>
<tr><td>30</td><td>$\overline{\mathrm{SC}}/\overline{\mathrm{TO}}$</td><td>O</td><td>Clock output of transfer of serial data with system control CPU</td><td>SS-38F/G board system control CPU (IC101)</td></tr>
<tr><td>31</td><td>SI</td><td>I</td><td>Input data for transfer of serial data with system control CPU</td><td>SS-38F/G board system control CPU (IC101)</td></tr>
<tr><td>32</td><td>V_{SS1}</td><td>I</td><td>GND</td><td></td></tr>
<tr><td>33</td><td>SO</td><td>O</td><td>Output data for transfer of serial data with system control CPU</td><td>SS-38F/G board system control CPU (IC101)</td></tr>
<tr><td>34</td><td>L. AUDIO</td><td>I</td><td>Signal input by front panel input change-over switch. Fixed to stereo in the case of line input.
"H":[LINE], [SIMUL CAST]or[AUDIO]
"L": [TUNER]</td><td></td></tr>
<tr><td>35</td><td>PCM ACT</td><td>I</td><td>Input signal indicating that PCM output signal is being reproduced during PB.
"H": PCM signal produced
"L": PCM signal not produced
PCM audio muted at "L"</td><td>IC101 pin 27</td></tr>
<tr><td>36</td><td>$\overline{\mathrm{IDTEST}}$</td><td>I</td><td>Test terminal for board adjustment At "L", PCM audio is muted in priority over all modes, as a result of PCM1 signal (pin 47) and PCM2 signal (pin 48) are set to "L".</td><td>Not connected</td></tr>
<tr><td>37</td><td>$\overline{\mathrm{SAP}}$</td><td>I</td><td>Unused</td><td></td></tr>
</table>

Table 6-9(2).

<table>
<tr><th>Pin</th><th>Display</th><th>I/O</th><th>Function・Operation</th><th>Connection</th></tr>
<tr><td>38</td><td>$\overline{\text{STEREO}}$</td><td>I</td><td rowspan="2">Input from tuner (EV-S700ES only)
• Writing of ID data
• Indication of audio multiplexing mode by subtimer CPU (FT-3C board IC002)
<table><tr><th>Tuner audio mode \ Input</th><th>$\overline{\text{STEREO}}$</th><th>$\overline{\text{BILING}}$</th></tr><tr><td>Mono</td><td>H</td><td>H</td></tr><tr><td>Stereo</td><td>L</td><td>H</td></tr><tr><td>Bilingual</td><td>H</td><td>L</td></tr></table></td><td rowspan="2">TA-28A board</td></tr>
<tr><td>39</td><td>$\overline{\text{BILING}}$</td><td>I</td></tr>
<tr><td>40</td><td>CAP ON IN</td><td>I</td><td>Signal indicating that capstan is turning.</td><td>SS-38F/G board system control CPU (IC101)</td></tr>
<tr><td>41</td><td>SEGEXT</td><td>I</td><td>Pilot detection signal for multi PCM</td><td></td></tr>
<tr><td>42</td><td>SFG</td><td>I</td><td>S reel rotational signal. Used for detection of remainder</td><td></td></tr>
<tr><td>43</td><td>SP/$\overline{\text{LP}}$</td><td>I</td><td>Input of decision on the recording time SP/LP</td><td>SS-38F/G board system control CPU (IC101)</td></tr>
<tr><td>44</td><td>$\overline{\text{IDREADY}}$</td><td>I</td><td>Control input for transfer of serial data with PCM ID CPU. Indicates that PCM ID CPU is transferrable.</td><td>PCM ID CPU (IC154)</td></tr>
<tr><td>45</td><td>T10/$\overline{\text{T13}}$</td><td>I</td><td>Tape thickness input. Used for detection of remainder.
"H": 10 μm tape
"L": 13 μm tape</td><td></td></tr>
<tr><td>46</td><td>$\overline{\text{AFMM}}$</td><td>O</td><td>Wait for muting of AFM output
H: Mute cancelled
L: Mute</td><td></td></tr>
<tr><td>47</td><td>PCM1</td><td>O</td><td rowspan="2">Muting signal for Lch and Rch of PCM
"H": Mute
"L": Mute cancelled</td><td rowspan="2"></td></tr>
<tr><td>48</td><td>PCM2</td><td></td></tr>
<tr><td>49</td><td>PB</td><td>O</td><td rowspan="2">PCM mode signal
<table><tr><th>Mode \ Output</th><th>PB</th><th>A REC</th></tr><tr><td>REC</td><td>L</td><td>L</td></tr><tr><td>AUDIO DUB</td><td>L</td><td>H</td></tr><tr><td>PB</td><td>H</td><td>L</td></tr><tr><td>AUDIO DUB</td><td>H</td><td>H</td></tr></table></td><td rowspan="2"></td></tr>
<tr><td>50</td><td>A REC</td><td>O</td></tr>
</table>

Table 6-9(3).

Pin	Display	I/O	Function • Operation	Connection
51	LOCK	O	PCM enable signal. Indicates that a mode of REC, PB or AUDIO DUB has been estabished. "H": PCM circuit mode established	
52	PCMPBM	O	On/off signal for muting during PB or REC mode "H": Mute "L": Mute released	
53	PCM RECM	O		
54	FD0	O	Data line for data transfer to timer CPU.	FT-3C/D board subtimer CPU (IC002)
55	FD1	O		
56	FD2	O		
57	FD3	O		
58	NC			
59	SEL1	O	Unused	
60	NC			
61	SLOW	O	"H" at time of slow frame feed	
62	V_{SS2}	I	GND	
63	V_{SS}	I		
64	V_{CC}	I	5V power supply	

Table 6-9(4).

(2) PCM1, PCM2, $\overline{\text{AFMM}}$ signal outputs, ID code and indication on fluorescent display tube

PCM1 and PCM2 are muting signals for PCM audio signals. $\overline{\text{AFMM}}$ is a muting signal for AFM audio signal. ID code is a code signal for identifying the audio mode (such as STEREO and BILINGUAL) recorded with PCM data. These are controlled by feature CPU. The feature CPU, in turn, transfers data to the subtimer CPU (FT-3C/D board IC002) for indication of audio mode on the fluorescent display tube.

(REC/E-E mode)

Note: Modes other than playback, special playback (CUE, REV, PB.PAUSE, SLOW, FRAME FEED, CONTINUOUS FRAME FEED and X2)

- PCM1, PCM2 signals, IC code, display on fluorescent display tube See Table 6-10.
  L. Audio = "H" (line, SIMUL CAST or AUTIO input)
  Controlled only by $\overline{\text{PCM}}$, $\overline{\text{AFM}}$. ID code is recorded in tape only in STEREO mode.
  Fluorescent tube display is also only in STEREO mode.
  L. Audio = "L" (Tuner input)
  Depends on whether PCM is "H" and AFM is "L" (AFM audio is produced or others.)
- $\overline{\text{AFMM}}$ signal
  See Table. 6-11.

"L" at time of audio dubbing and audio dubbing pause. In other modes, "L" if Multi is "H", and depends on PCM and AFM imput if Multi is "L".

<table>
<tr><th colspan="9">Input</th><th colspan="4">Output</th></tr>
<tr><th>$\overline{\text{PCM}}$ IC001 ⑲</th><th>$\overline{\text{AFM}}$ IC001 ⑳</th><th>$\overline{\text{MAIN}}$ IC001 ⑰</th><th>$\overline{\text{M/S}}$ IC001 ⑱</th><th>MULTI IC001 ⑧</th><th>PCM ACT IC001 ㉟</th><th>L. AUDIO IC001 ㉞</th><th>$\overline{\text{STEREO}}$ IC001 ㊳</th><th>$\overline{\text{BILINGUAL}}$ IC001 ㊴</th><th>PCM1 IC001 ㊼</th><th>PCM2 IC001 ㊽</th><th>ID code (B1, B2)</th><th>Fluorescent tube display</th></tr>
<tr><td>L</td><td>L</td><td rowspan="4">*</td><td rowspan="4">*</td><td rowspan="4">*</td><td rowspan="4">*</td><td rowspan="4">H</td><td rowspan="4">*</td><td rowspan="4">*</td><td>L</td><td>L</td><td rowspan="4">(0, 1)</td><td rowspan="4">STEREO</td></tr>
<tr><td>L</td><td>H</td><td>L</td><td>L</td></tr>
<tr><td>H</td><td>H</td><td>L</td><td>L</td></tr>
<tr><td>H</td><td>L</td><td>H</td><td>H</td></tr>
<tr><td rowspan="4">H</td><td rowspan="4">L</td><td rowspan="4">*</td><td rowspan="4"></td><td rowspan="11">*</td><td rowspan="11">*</td><td rowspan="11">L</td><td>L</td><td>L</td><td rowspan="4">H</td><td rowspan="4">H</td><td>(0, 1)</td><td>STEREO</td></tr>
<tr><td>H</td><td>H</td><td>(0, 0)</td><td>—</td></tr>
<tr><td>H</td><td>L</td><td>(1, 0)</td><td>BILINGUAL</td></tr>
<tr><td>L</td><td>H</td><td>(1, 1)</td><td>—</td></tr>
<tr><td rowspan="7" colspan="2">In case other than above (H. L)</td><td>*</td><td>*</td><td>L</td><td>L</td><td>L</td><td>L</td><td>(0, 1)</td><td>STEREO</td></tr>
<tr><td>*</td><td>*</td><td>H</td><td>H</td><td>L</td><td>L</td><td>(0, 0)</td><td>—</td></tr>
<tr><td>L</td><td>L</td><td rowspan="4">H</td><td rowspan="4">L</td><td>L</td><td>L</td><td rowspan="4">(1, 0)</td><td rowspan="4">BILINGUAL</td></tr>
<tr><td>L</td><td>H</td><td>H</td><td>L</td></tr>
<tr><td>H</td><td>H</td><td>L</td><td>H</td></tr>
<tr><td>H</td><td>L</td><td>L</td><td>L</td></tr>
<tr><td>*</td><td>*</td><td>L</td><td>H</td><td>L</td><td>L</td><td>(1, 1)</td><td>—</td></tr>
</table>

Table 6-10. PCM1, PCM2 signal, fluorescent tube diaplay and ID cord for REC/E-E

<table>
<tr><th colspan="9">Input</th><th>Output</th></tr>
<tr><th>$\overline{\text{PCM}}$ IC001 ⑲</th><th>$\overline{\text{AFM}}$ IC001 ⑳</th><th>$\overline{\text{MAIN}}$ IC001 ⑰</th><th>$\overline{\text{M/S}}$ IC001 ⑱</th><th>MULTI IC001 ⑧</th><th>PCM ACT IC001 ㉟</th><th>L. AUDIO IC001 ㉞</th><th>$\overline{\text{STEREO}}$ IC001 ㊳</th><th>$\overline{\text{BILIGUAL}}$ IC001 ㊴</th><th>$\overline{\text{AFMM}}$ IC001 ㊻</th></tr>
<tr><td>L</td><td>L</td><td rowspan="4">*</td><td rowspan="4">*</td><td rowspan="4">L</td><td rowspan="4">*</td><td rowspan="4">*</td><td rowspan="4">*</td><td rowspan="4">*</td><td>L</td></tr>
<tr><td>L</td><td>H</td><td>L</td></tr>
<tr><td>H</td><td>H</td><td>H*1</td></tr>
<tr><td>H</td><td>L</td><td>H*1</td></tr>
<tr><td>*</td><td>*</td><td>*</td><td>*</td><td>H</td><td>*</td><td>*</td><td>*</td><td>*</td><td>L</td></tr>
</table>

*1 "L" at time of AUDIO DUB and AUDIO DUB pause

Table 6-11. $\overline{\text{AFMM}}$ signal for REC/E-E

(PB mode)

See Tables 6-12 and 6-13. Since tape playback is involved, the operation is not related to L. Audio, $\overline{\text{STEREO}}$, $\overline{\text{BILINGUAL}}$ input for tuner. When PCM ACT is "L", PCM1 is "H" and PCM2 "L" regardless of other conditions. When MULTI is "H", $\overline{\text{AFMM}}$ is "L" regardless of other conditions.

(Special playback mode)

At the time of special playback (CUE, REV, PB.PAUSE, SLOW, FRAME FEED, CONTINUOUS FRAME FEED and X2) no audio is produced. Thus, unconditionally, PCM1 is "H", PCM2 "H", and $\overline{\text{AFMM}}$ "L".

Input										Output		
Read ID data (B1, B2)	$\overline{\text{PCM}}$ IC001 ⑲	$\overline{\text{AFM}}$ IC001 ⑳	$\overline{\text{MAIN}}$ IC001 ⑰	$\overline{\text{M/S}}$ IC001 ⑱	MULTI IC001 ⑧	PCM ACT IC001 ㉟	L. AUDIO IC001 ㉞	$\overline{\text{STEREO}}$ IC001 ㊳	$\overline{\text{BILINGUAL}}$ IC001 ㊴	PCM1 IC001 ㊼	PCM2 IC001 ㊽	Fluorescent tube display
Stereo (0, 1)	L	L	*	*	*	H	*	*	*	L	L	STEREO
	L	H								L	L	
	H	H								L	L	
	H	L								H	H	
Monaural (0, 0)	H	L	*	*						H	H	—
	In case other than above		L	L						L	L	
			L	H						H	L	
			H	H						L	H	
			H	L						L	L	
Bilingual (1, 0)	H	L	*	*						H	H	BILINGUAL
	In case other than above		L	L						L	L	
			L	H						H	L	
			H	H						L	H	
			H	L						L	L	
No ID data, etc. (1, 1)	H	L	*	*						H	H	—
	In case other than above		L	L						L	L	
			L	H						H	L	
			H	H						L	H	
			H	L						L	L	
	*	*	*	*	*	L	*	*	*	H	H	—

Table 6-12. PCM1, PCM2 signals during PB

Input										Output
Read ID data	$\overline{\text{PCM}}$ IC001 ⑲	$\overline{\text{AFM}}$ IC001 ⑳	$\overline{\text{MAIN}}$ IC001 ⑰	$\overline{\text{M/S}}$ IC001 ⑱	MULTI IC001 ⑧	PCM ACT IC001 ㉟	L. AUDIO IC001 ㉞	$\overline{\text{STEREO}}$ IC001 ㊳	$\overline{\text{BILINGUAL}}$ IC001 ㊴	$\overline{\text{AFMM}}$ IC001 ㊻
*	L	L	*	*	L	H	*	*	*	L
						L				H[*3]
	L	H				H				L
						L[*1]				L
						L[*2]				H[*3]
	H	H				*				H[*3]
	H	L				*				H[*3]
*	*	*	*	*	H	*	*	*	*	L

Table 6-13. $\overline{\text{AFMM}}$ signal during PB

*1. When time of PCM ACT "L" is less than a second.
*2. When time of PCM ACT "L" is a second or longer.
*3. "L" is involved when decision on SEG EXT signal shows more than one recorded segments.

(4) PCM shift CPU (PC-15B board, IC151, 152 and 153)

IC151 to IC153 are quite the same CPUs (MB88201-202N) and have three switching functions of shift of RF SW pulse, shift of SERVO REF and FE output with two switching ports.

Function \ Switching input	SEL0 (pin ⑩)	SEL1 (pin ⑪)
Shift of RF SW pulse	H	Don't Care
Shift of SERVO REF pulse	L	H
Generation of FE timing	L	L

Table 6-14.

The switching of normal and multi 1 to 6 are applied to all three CPUs in common in the following codes:

Function \ Switching input	CHC (pin ①)	CHB (pin ⑭)	CHA (pin ⑬)
Multi 1	L	L	L
Multi 2	L	L	H
Multi 3	L	H	L
Multi 4	L	H	H
Multi 5	H	L	L
Multi 6	H	L	H
Unused	H	H	L
Normal	H	H	H

Table. 6-15.

Note 1: "Normal" is defined as a recording/playback mode of VIDEO + AFM or VIDE + AFM + PCM.

1. Shift of RF SW pulse (PC-15B board IC152)
Description of terminal function

Pin	Display	I/O	Function・Operation	Connection
2	NC			
3	MRF SW SEL	O	An output of RF SW pulse converted to normal, multi 1 to 6, used for ATF control	SS-38F/G board system control CPU
4	RF SW PULSE	I	Reference input for producing MRF SW FLS, MRF SW SEL	
5	RP PB	I	Control input for MRF SW SEL conversion	
6	X	O	Unused	
7	EX	I	System clock	
8	Vss	I	GND	
9	MRF SW PLS	O	Output of RF SW pulse converted for normal, multi 1 to 6, used for shifting PCM playback area	RP-25C board
12	NC			
15	$\overline{\text{RST}}$	I	Reset input	FT-3C/D board subtimer CPU (IC002)
16	Vcc	I	5V power supply	

Table 6-16.

- **Timing chart**

i) Playback mode of Multi 2 to 6

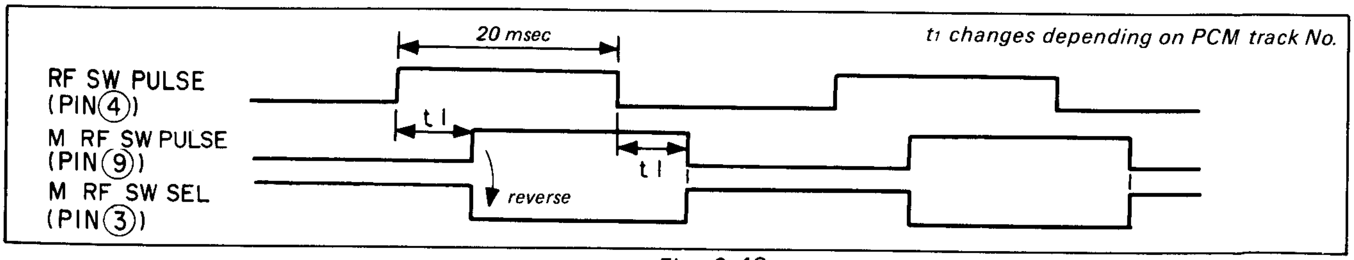


Fig. 6-48.

ii) Playback mode of Normal/Multi 1 or all recording modes

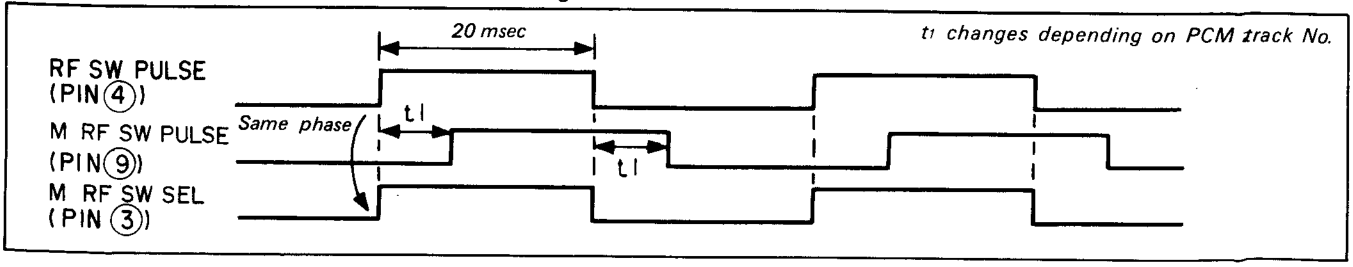


Fig. 6-49.

2. Shift of SERVO REF pulse (PC-15B board IC153)

Description of terminal functions

Pin	Display	I/O	Function・Operation	Connection
2	AFRST	O	Reset pulse, reset of IC101 (CX-23078)	
3	MLT TRK	O	"H" in multi mode, and "L" in normal mode	Feature CPU (IC001)
4	SERVO REF PLS	I	Reference input for producing M SERVO REF PLS	SS-38F/G board (CX20135) IC201
5	$\overline{\text{CHCNG}}$	O	Produced when track No. changes. Used for muting.	
6	X	O	Unused	
7	EX	I	System clock	
8	Vss	I	GND	
9	M SERVO REF PLS	O	An output of SERVO REF PLS converted for normal multi 1 to 6, used for shifting playback area of PCM	
12	NC			
15	$\overline{\text{RST}}$	I	Reset input	FT-3C/D board subtimer CPU (IC002)
16	Vcc	I	5V power supply	

Table 6-17.

• **Timing chart**

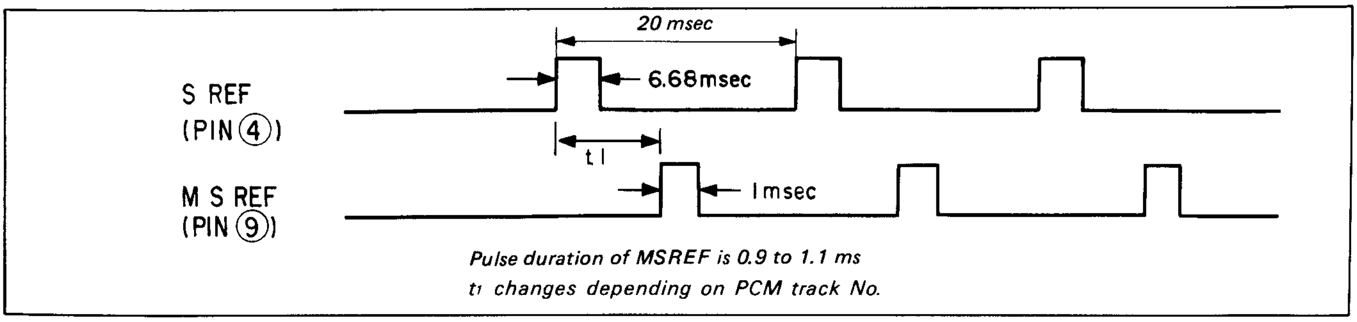


Fig. 6-50.

3. Generation of FE timing (PC-15B board C151)

Discription of terminal functions

Pin	Display	I/O	Function・Operation	Connection
2	AFFERA	O	Mask output for video signal at time of audio dubbing	
3	AFFERS	O	Flying erase output at time of audio dubbing	
4	RFSWPLS	I	Reference output for $\overline{\text{MFEON}}$, AFFERA and AFFERS outputs	
5	AF REC	I	Input signal for audio dubbing mode	SS-38F/G board system control CPU (IC101)
6	SP/$\overline{\text{LP}}$	I	Recording time SP/LP input. No flying erase in audio dubbing mode in case of LP.	SS-38F/G board system control CPU (IC101)
7	EX	I	System clock	
8	Vss	I	GND	
9	$\overline{\text{MFEON}}$	O	Flying erase timing output corresponding to normal, multi 1 to 6	RP-25D board through SS-38F/G board IC105
12	$\overline{\text{FEON}}$	I	Control input for producing $\overline{\text{MFEON}}$.	SS-38F/G board system control CPU
15	$\overline{\text{RST}}$	I	Reset input	FT-3C/D board main timer CPU (IC001)
16	Vcc	I	5V power supply	

Table 6-18.

• Timing chart

(A) Normal recording $\left(\begin{array}{l} \text{AF REC=L} \\ \text{SP/}\overline{\text{LP}}\text{= *} \end{array} \text{CH-A, B, C=H, H, H} \right)$

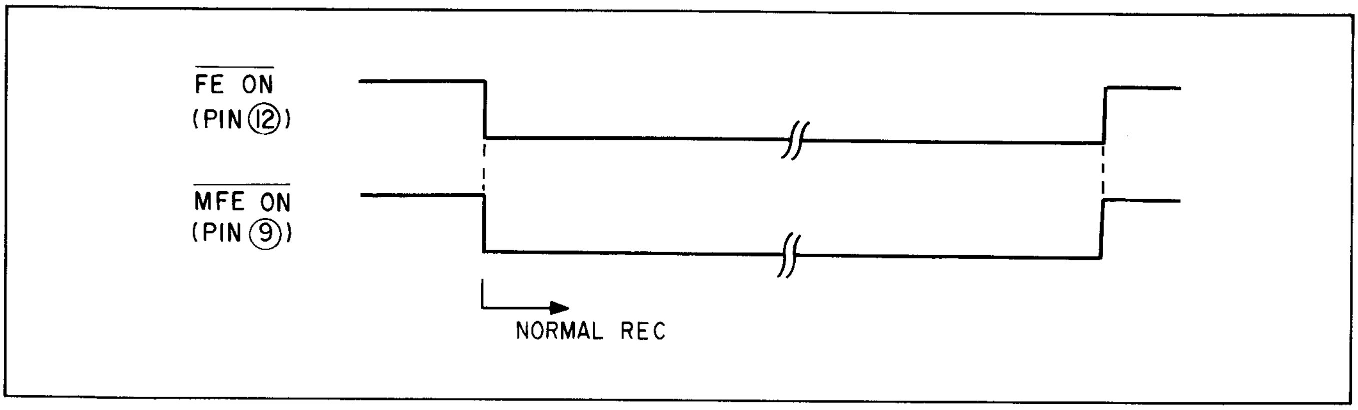


Fig. 6-51.

(B) SP mode audio dubbing $\left(\begin{array}{l} \overline{\text{FE ON}}\text{=H} \quad \text{SP/}\overline{\text{LP}}\text{=H} \\ \text{AF REC=H} \quad \text{CH-A, B, C=H, H, H} \end{array} \right)$

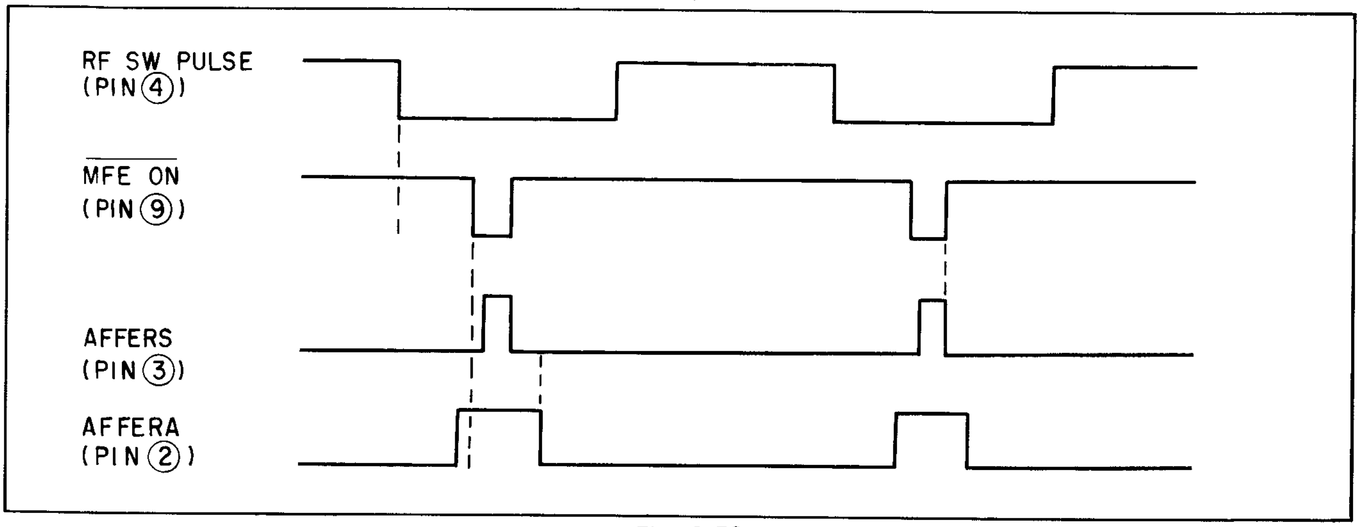


Fig. 6-52.

(c) Multi PCM recording $\left(\begin{array}{l} \overline{\text{FE ON}} = \text{L} \quad \text{SP/}\overline{\text{LP}} = * \\ \text{AF REC} = \text{L} \quad \text{CH A, B, C = H, H, H or other than L, H, H} \end{array} \right)$

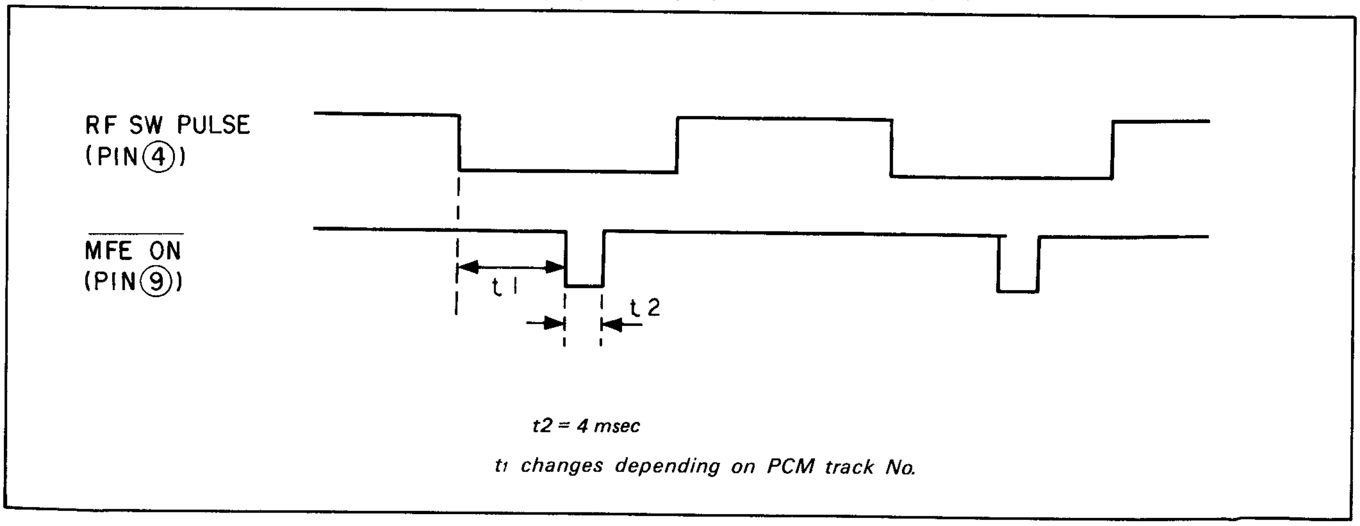


Fig. 6-53.

(5) PCM ID CPU (PC-15B board IC154: MB88201-204N)

Description of terminal functions

Pin	Display	I/O	Function · Operation	Connection
1	XIDRED	O	Serial data for recording against IC102 (CX23061)	IC102 pin 35
2	XIDPBD	I	Serial data for playback against IC102 (CX23061)	IC102 pin 34
3	PB	I	Mode input. Designates transfer direction of serial data	Feature CPU (IC001 pin 49)
4	RCHG	I	Reference input for determining data transfer period with IC102 (CX23061)	IC102 pin 43
5	$\overline{\text{IDENA}}$	I	Input indicating that data transfer with feature CPU is effective.	Feature CPU (IC001 pin 3)
6	NC			
7	EX	I	System clock	
8	Vss	I	GND	
9	IDCLK	I	Clock for data transfer with feature CPU	Feature CPU (IC001 pin 1)
10	$\overline{\text{IDREADY}}$	O	Indicates that data is being transferred by IC102 (CX23061). 'H' indicates transfer.	Feature CPU (IC001 pin 44)
11	IDPBDATA	O	Data line for data transfer to feature CPU.	Feature CPU (IC001 pin 9)
12	IDRECD	I	Data line for data transfer to feature CPU.	Feature CPU (IC001 pin 2)
13	XSCK	O	Clock for data transfer with IC102 (CX23061)	IC102 pin 37
14	$\overline{\text{XCE}}$	O	Chip enable signal for data transfer with IC102 (CX23061)	IC102 pin 36
15	$\overline{\text{Reset}}$	I	Reset input	FT-3C/D board subtimer CPU(IC002)
16	Vcc	I	5V power supply	

Table 6-19.

SECTION 7
POWER SUPPLY SECTION

7-1. OUTLINE

The major power supply systems of this equipment are as follows: as the constant voltage systems of the closed loop, there are REG 9V (tuner, changeable speed playback video system, etc.), REG 5V (main signal system), BACK UP 5V (timer system), and UNSW 5V (system control/servo microcomputer system), and for the open loop system, there are DRIVE 9V (drum motor and capstan motor), DRIVE 5V (control motor, loading motor, and plunger), UNSW −30V (timer, for channel memory), UNSW 35V (for tuner), LED 9V (for front function display LED), and, in addition, UNSW ±9V and AUDIO ±6V for the audio analog systems and AC 5.6V of power supply for the heater of the display tube.

7-2. OPERATION (See Fig. 7-1)

Switch ON/OFF of the power supply is controlled by regulator IC301 of PS-84A/B board. When the power supply switch of the equipment is ON, a LOW signal ($\overline{\text{POWER ON}}$) from the timer microcomputer is fed to the base of Q210 and thus Q210 becomes OFF. Owing to this, the base current of Q2 within IC301 flows to turn Q2 ON and REG 5V and REG 9V are output. Moreover, by outputting REG 9V, Q212 and Q211 become ON, and the base currents of Q202 and Q204 flow and DRIVE 9V and 5V are output from the respective collectors. In IC202, AUDIO 6V is output by the non-reversed amplifier (pins 2 , 3 , and 4 of IC202) which uses the OP AMP on the basis of REG 5V, and AUDIO −6V is output by the reversed amplifier (pins 6 , 7 , and 8 of IC 202). (See Fig. 7-2) When the power switch is OFF, signal of HIGH from the timer microcomputer is fed to the base of Q210 and Q210 becomes ON, and the base current of Q2 within IC301 does not flow. Accordingly, output REG 9V of IC301 and REG 5V become 0V. As REG 9V becomes 0V, Q212 and Q211 also become OFF. Consequently, the base current of the power transistors Q202 and Q204 of the DRIVE 9V and 5V systems is not supplied, and therefore, both the outputs become 0V. AUDIO 6V and AUDIO −6V which are generated on the basis of REG 5V do not output and all the SW'D system power supplies become into OFF state.

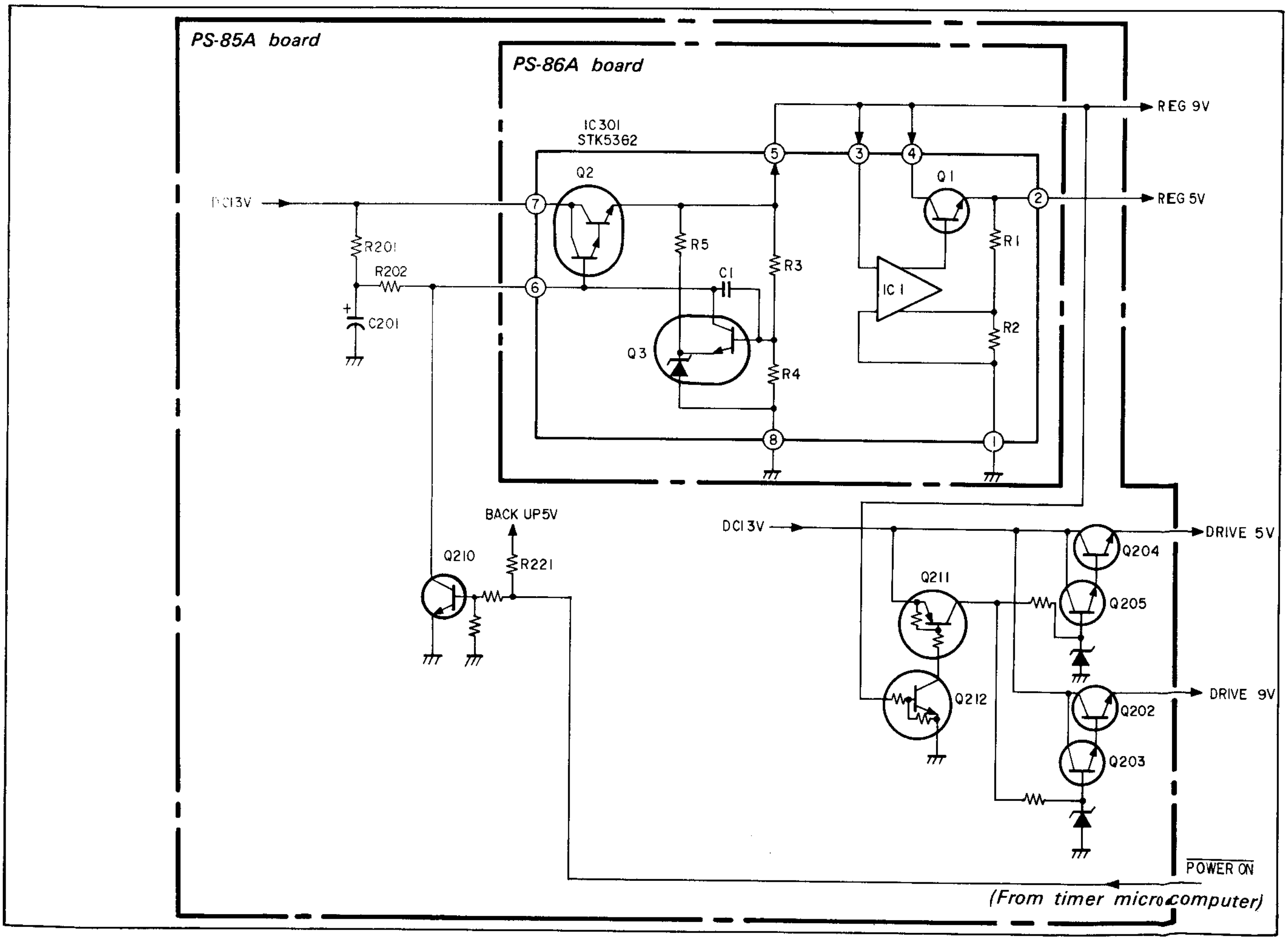


Fig. 7-1.

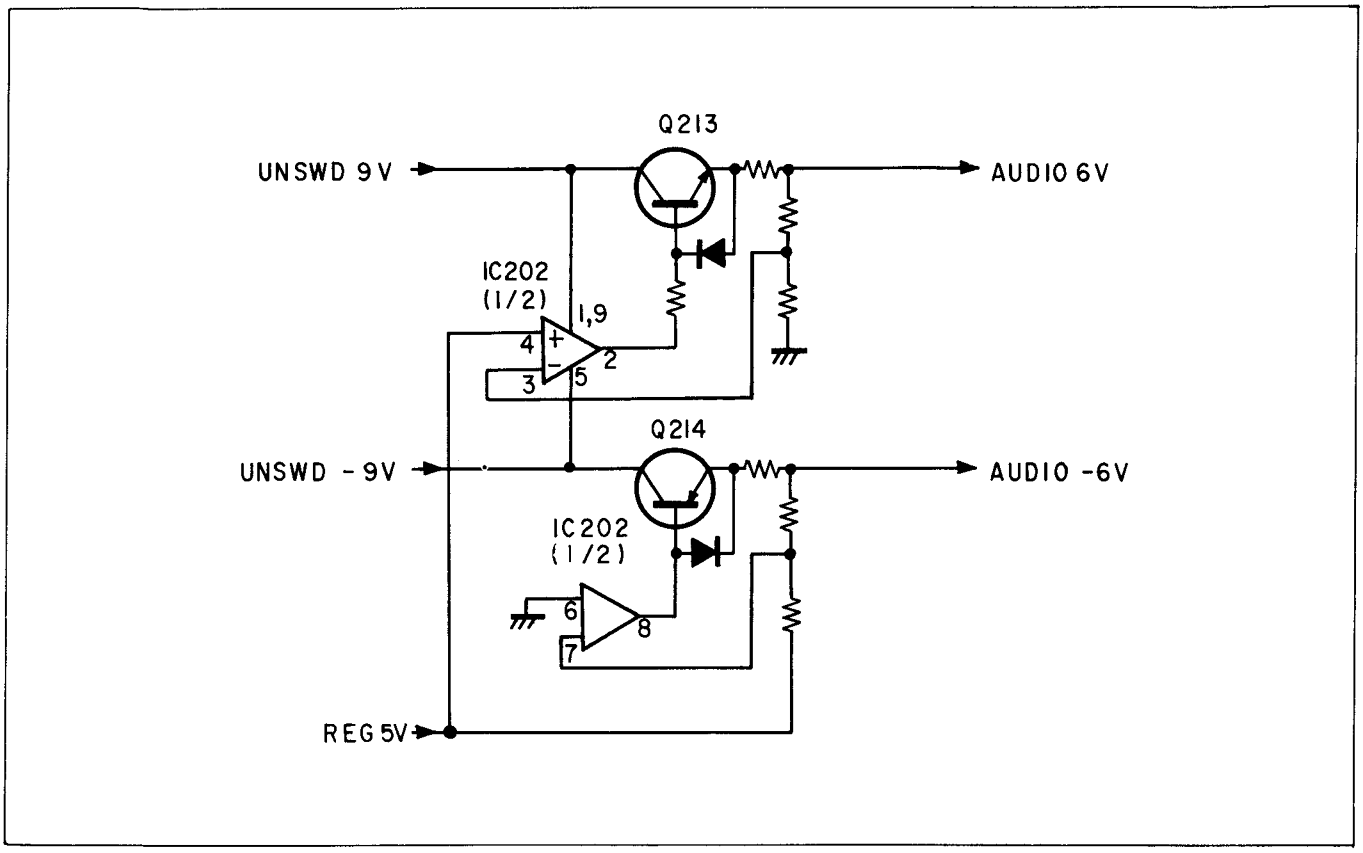

Q213
UNSWD 9V
AUDIO 6V
IC202
(1/2)
1,9
4
+
−
2
3
5
Q214
UNSWD -9V
AUDIO -6V
IC202
(1/2)
6
8
7
REG 5V

Fig. 7-2.

SECTION 8
TIMER CIRCUIT

Timer circuit consists mainly of the main timer CPU (IC001) and the sub-timer CPU (IC002) on the FT-3C/D board. The main timer CPU and the sub-timer CPU provide the following performance:

1) ON/OFF control of power supply.
2) Timer reserving, clock key reading and execution.
3) Key select, counter-reset, tape return, ×2, slow, step, input changeover, SP/LP key reading.
4) FIP (Flourescent Display Tube) display.
5) Displayed data acceptance
6) Current failure detection
7) Infrared or control S remote control signal reception and execution
8) Multi-PCM channel decision.

8-1. MAIN TIMER CPU AND Sub-TIMER CPU:

Both the main timer CPU and the sub-timer CPU are 4-bit microcomputer μPD7519HG and they are different from each other only in the ROM memory programming. The computer μPD7519HG is a CMOS type 4096 words × 8 bits ROM, 256 words × 4 bits RAM, with 64 pins and flat package. It also provides the ability to directly drive the FIP and the power-down function by which power consumption is saved in the case of current failure.

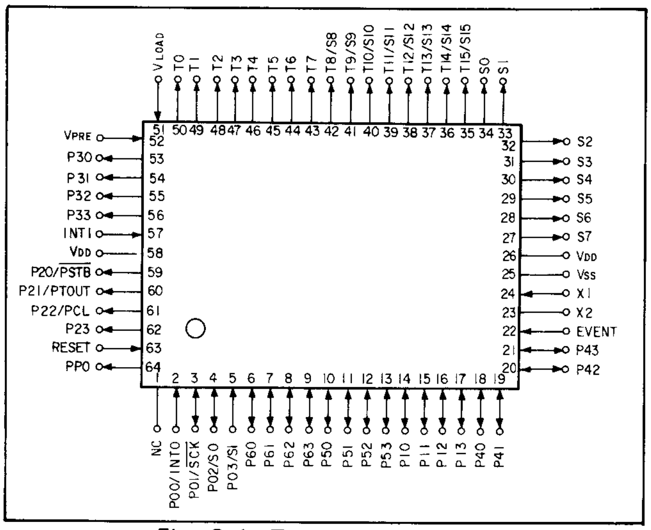


Fig. 8-1. Terminals Layout

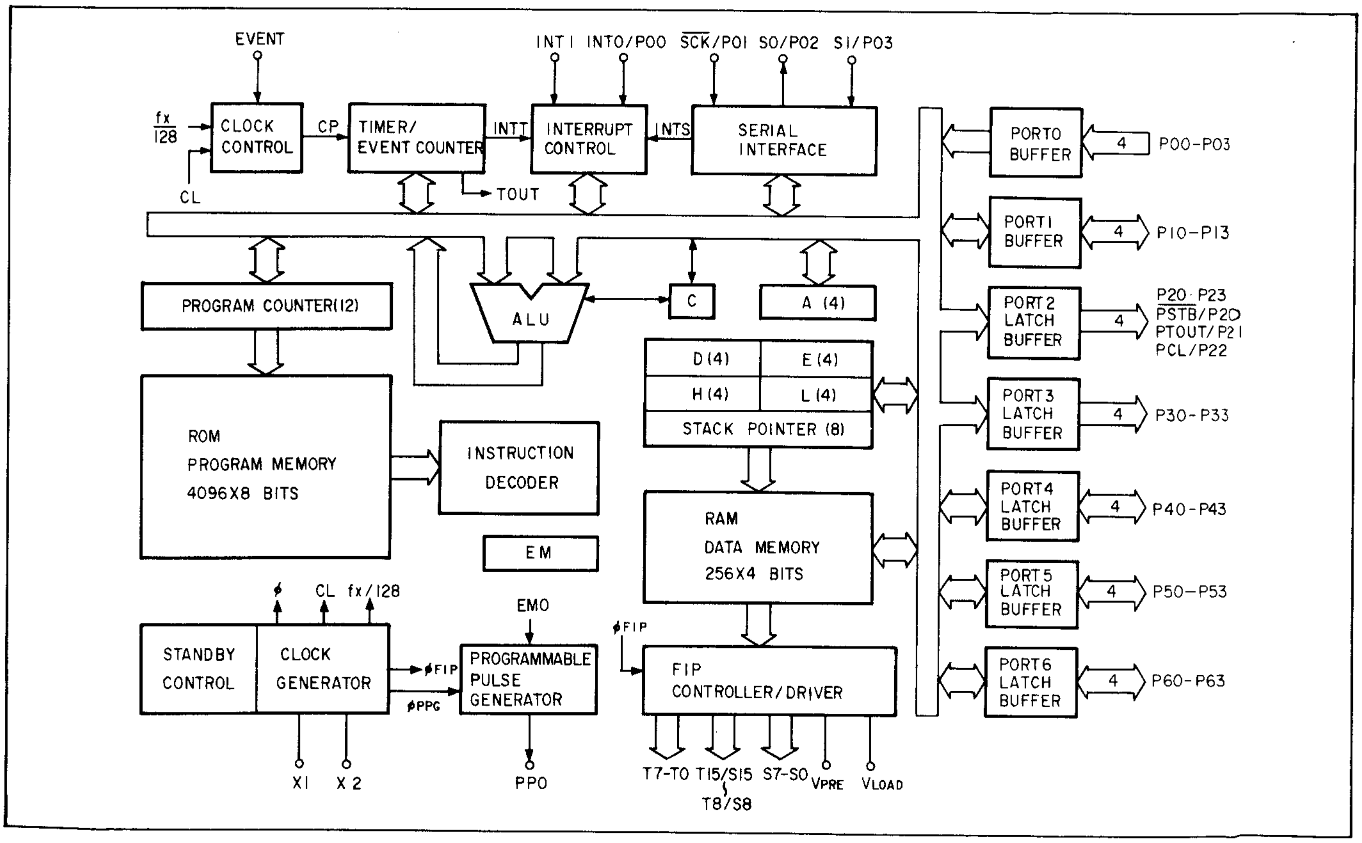


Fig. 8-2. Interior Block Diagram

1) Main Timer CPU (FT-3A board, IC001)

Pin	Display	I/O	Function and Performance	Connection
1	NC			
2	REQ SMT	O	Data transmission request signal from system computer CPU to timer CPU	SS-38F/G board system control CPU (IC101)
3	$\overline{\text{SMT CK}}$	I	Shift lock for timer CPU/sys-com CPU serial transmission	System control CPU (IC101) through Q104 of SS-38F/G board
4	MTS DATA	O	Serial data from timer CPU to sys-com CPU	System control CPU (IC101) through Q105 of SS-38F/G board
5	SMT DATA	I	Serial data from sys-com CPU to timer CPU	SS-38F/G board system control CPU (IC101)
6	CHA	O	Normal/Multi switchover of PCM and multi PCM track	PC-15B board shift CPU (IC151 to 153)
7	CHB	O		
8	CHC	O		
9	RESETS	O	Sys-com CPU reset output	SS-38F/G board system, control CPU (IC101), Emergency CPU (IC109), servo CPU (IC303)
10	REC LED	O	REC LED on/off output	D032
11	PAUSE LED	O	PUASE LED on/off output	D204 of FU-33A board
12	PB LED	O	PB LED on/off output	D201 of FU-33A board
13	$\overline{\text{EJECT LED}}$	O	EJECT LED on/off output	D302 of PW-9A board
14	LEVEL L	I	Lch audio level detection input	Pin 7 of IC004
15	REQ SM	I	Transmission request signal from sub-timer CPU	Sub-timer CPU (IC002)
16	SUB DATA	I	Serial data from sub-timer CPU	Sub-timer CPU (IC002)
17	LEVEL R	I	Rch audio level detection input	Pin 1 of IC004
18	$\overline{\text{MCLK}}$	O	Clock for transmission of serial data from sub-timer CPU	Sub-timer CPU (IC002)
19	REQ MS	O	Serial data transmission request signal to sub-timer CPU	Sub-timer CPU (IC002)
20	MAIN DATA	O	Serial data to sub-timer CPU	Sub-timer CPU (IC002)
21	LINE AUDIO	O	Changeover output for audio input signal	PC-14B board
22	AC REF	I		Power supply block
23	X2	O	System clock (4.19 MHz)	IC003
24	X1	I		
25	GND	I		
26	V_{DD}	I		
27	S7	O	FIP drive output (segment)	Pin 52 of FIP (Fluorescent display tube)
28	S6	O		Pin 30 of FIP (Fluorescent display tube)
29	S5	O		Pin 32 of FIP (Fluorescent display tube)
30	S4	O		Pin 29 of FIP (Fluorescent display tube)
31	S3	O		Pin 25 of FIP (Fluorescent display tube)
32	S2	O		Pin 26 of FIP (Fluorescent display tube)

Table 8-1 (1).

Pin	Display	I/O	Function and Operation	Connection
33	S1	O	FIP drive output (segment)	Pin 33 of FIP (Fluorescent display tube)
34	S0	O		Pin 34 of FIP (Fluorescent display tube)
35	T15/S15	O		Pin 51 of FIP (Fluorescent display tube)
36	T14/S14	O		Pin 49 of FIP (Fluorescent display tube)
37	T13/S13	O		Pin 37 of FIP (Fluorescent display tube)
38	T12/S12	O		Pin 40 of FIP (Fluorescent display tube)
39	T11/S11	O		Pin 39 of FIP (Fluorescent display tube)
40	T10/S10	O		Pin 41 of FIP (Fluorescent display tube)
41	T9/S9	O		Pin 36 of FIP (Fluorescent display tube)
42	T8/S8	O		Pin 27 and 48 of FIP (Fluolescent display tube)
43	T7	O	FIP drive output (grid)	Pin 17 of FIP (Fluorescent display tube)
44	T6	O		Pin 20 and 24 of FIP (Fluorescent display tube)
45	T5	O		Pin 28 of FIP (Fluorescent display tube)
46	T4	O		Pin 31 of FIP (Fluorescent display tube)
47	T3	O		Pin 35 of FIP (Fluorescent display tube)
48	T2	O		Pin 38 of FIP (Fluorescent display tube)
49	T1	O		Pin 42 of FIP (Fluorescent display tube)
50	T0	O		Pin 45 and 50 of FIP (Fluorescent display tube)
51	VLOAD	I	FIP drive voltage	
52	VPRE	I		
53	DA0	O	Audio level detection output signal	
54	DA1	O		
55	DA2	O		
56	DA3	O		
57	INT1	I	Interruption signal to REQUEST	
58	VDD	O	Power supply 5V	
59	RQT MTS	O	Sys-com CPU serial data transmission request signal	SS-38F/G board system control CPU (IC101)
60	LINE VIDEO	O	Video input signal switching signal	VI-9A board and PC-14B board
61	VTR/$\overline{\text{TV}}$	O	VTR/TV switching signal for TV	AV connector through Q213 and Q218 of VI-9A board
62	$\overline{\text{POWER ON}}$	O	Power on/off control	Power supply block
63	RESET	I	Reset input	IC107 of SS-38F/G board
64	PWM	O	Tuner tuning PWM output	

Table 8-1 (2).

2) **Sub-timer CPU (FT-3A board IC002)**

Pin	Display	I/O	Function and Operation	Connection
1	NC			
2	REMOTE T	I	Infra-red remote control, Control S input.	IC005
3	$\overline{\text{MCLK}}$	I	Serial clock from main timer CPU	Main timer CPU (IC001)
4	SUB DATA	O	Serial data to main timer CPU	Main timer CPU (IC001)
5	MAIN DATA	I	Serial data from main timer CPU	Main timer CPU (IC001)
6	REQ SM	O	Serial transfer request signal to main timer CPU	Main timer CPU (IC001)
7	REQ MS	I	Serial transfer request signal from main timer CPU	Main timer CPU (IC001)
8	ACK	O	Control output for data transfer from Feature CPU	PC-15B board feature CPU (IC001)
9	$\overline{\text{AUTO LEVEL}}$	I	On/off control input of "AUTO LEVEL" display	
10	MLT/$\overline{\text{NRM}}$ TMR	I	Normal/Multi P/Multi S reserving timer PCM mode switching input	SO22
12	$\overline{\text{PWR SW}}$	I	Power on/off key reading	S001 of PW-9A board
13	AC REF	I	Current failure detection	Power supply block
14	KIN0	I	Key matrix input	
15	KIN1	I		
16	KIN2	I		
17	KIN3	I		
18	FD0	I	Input of data from Feature CPU	PC-15B board feature CPU (IC001)
19	FD1	I		
20	FD2	I		
21	FD3	I		
22	EVENT	I	Not in use	
23	X2	O	System clock (4.19 MHz)	IC003
24	X1	I		
25	Vss	I		
26	VDD	I	Power supply 5V	
27	S7	O	Unused	
28	S6	O	FIP drive output (segment drive)	Pin 21 of FIP (Fluorescent display tube)
29	S5	O		Pin 22 of FIP (Fluorescent display tube)
30	S4			Pin 15 of FIP (Fluorescent display tube)
31	S3			Pin 23 of FIP (Fluorescent display tube)
32	S2			Pin 16 of FIP (Fluorescent display tube)
33	S1			Pin 18 of FIP (Fluorescent display tube)
34	S0			Pin 19 of FIP (Fluorescent display tube)
35	T15/S15			Pin 3 of FIP (Fluorescent display tube)
36	T14/S14			Pin 6 of FIP (Fluorescent display tube)
37	T13/S13			Pin 13 of FIP (Fluorescent display tube)
38	T12/S12			Pin 12 of FIP (Fluorescent display tube)

Table 8-2 (1).

Pin	Display	I/O	Function and Operation	Connection
39	T11/S11		FIP drive output (segment drive)	Pin ⑩ of FIP (Fluorescent display tube)
40	T10/S10			Pin ⑨ of FIP (Fluorescent display tube)
41	T9/S9			Pin ⑦ of FIP (Fluorescent display tube)
42	T8/S8			Pin ④ of FIP (Fluorescent display tube)
43	CLAMP	O	Cassette lamp illumination output	
44	AFREC LED	O	AUDIO DUB LED ON output	D031
45	REW LED	O	REW LED ON output	D205 of FU-33A board
46	FF LED	O	FF LED ON output	D202 of FU-33A board
47	T3	O	Not in use	
48	T2	O	FIP drive output (grid drive)	Pin ⑤ of FIP (Fluorescent display tube)
49	T1	O		Pin ⑧ of FIP (Fluorescent display tube)
50	T0	O		Pin ⑪ and ⑭ of FIP (Fluolescent display tube)
51	VLOAD	I	FIP drive voltage	
52	VPRE	I		
53	KOUT 0	O	Key matrix output	
54	KOUT 1	O		
55	KOUT 2	O		
56	KOUT 3	O		
57	INT1	I	Input of interruption corresponding with REMOTE T	
58	VDD	I	Power supply 5V	
59	CHECK LED	O	Double function key check display.	D029
60	LED ON OUTPUT.	O	Double function key lower side display LED ON output	D027 and D028
61	$\overline{\text{F RESET}}$	O	Feature CPU, etc. reset output	PC-15B board shift CPU Feature CPU, PCMID CPU
62	LED OFF OUTPUT.	O	Double function upper side display LED ON output	D016, 019, 020
63	RESET	I	Reset input	IC107 of SS-38F/G board
64	KOUT 4	O	Key scanning output	

Table 8-2 (2).

8-2. DATA TRANSFER BETWEEN MAIN TIMER CPU AND SYSTEM CONTROL CPU.

The data transfer is carried out between the main timer CPU and the system control CPU. The following commands are transmitted from the main timer CPU to the system control CPU :

1. The sub-timer is responsible for such operations as X2, slow, step, etc. and the related key commands are data-transferred by sub-timer CPU.
2. The commands by infrared remote control signal or control S remote control signal are data transferred by the sub-timer CPU.
3. The timer image transcription command by means of program stored in the memory within the main timer CPU.

The following data are transferred from the system control CPU to the main timer CPU :

1. VTR mode display data:
   REC, PB, FF, REW, PAUSE, SP/LP, etc.
2. Tuner mode display data:
   Channel, band *1, Tune display, multi-sound mode.
3. Counter display data:
4. Timer recording availability.
   REC READY.

*1: EV-S700ES only

The data transfer is carried out by means of an 8-bit serial port. The necessary signal wires are as follows: Five wires, i.e., SMTCK, SMTDATA, MTSDATA, PQTSMT and RQTMTS.

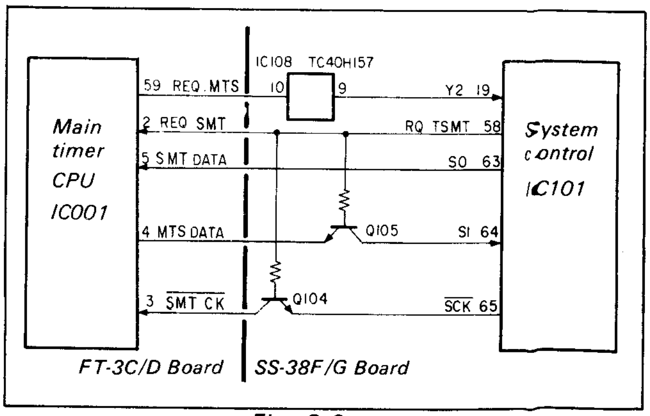
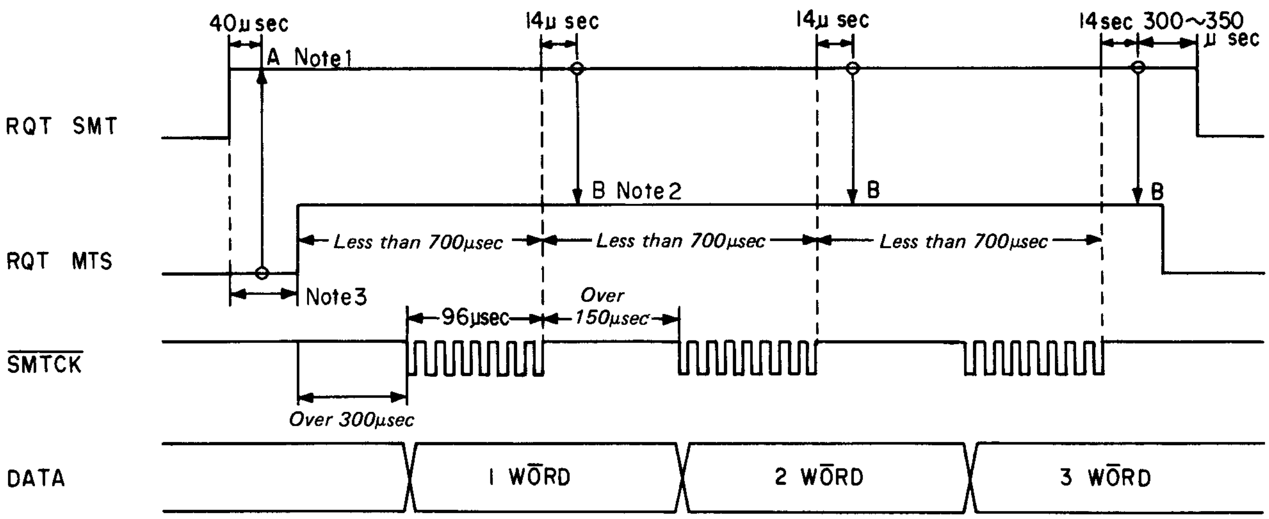


Fig. 8-3.

(1) Data transfer request:

There are two types of requests, i.e., request from the system control CPU and the timer CPU within.

1 Communication request from system control CPU:



Note 1)

40 μsec after the RQT SMT signal is set to "H", timer CPU will monitor the RQT SMT signal level (Point A), and, displays RQT MTS = "H" if it is in "H".

Note 2)

In the course of data transmission, at Point B of each 8 bits, the system control monitors RQTMTS. If it is in "L", RQTSMT = "L" is displayed after 30 usec.

Note 3)

After the system control displays RQTSMT = "H", in 300 μsec, if RQTMTS = "H" is not displayed, the system control does RQT SMT = "L".

Fig. 8-4.

2 Request from timer CPU:

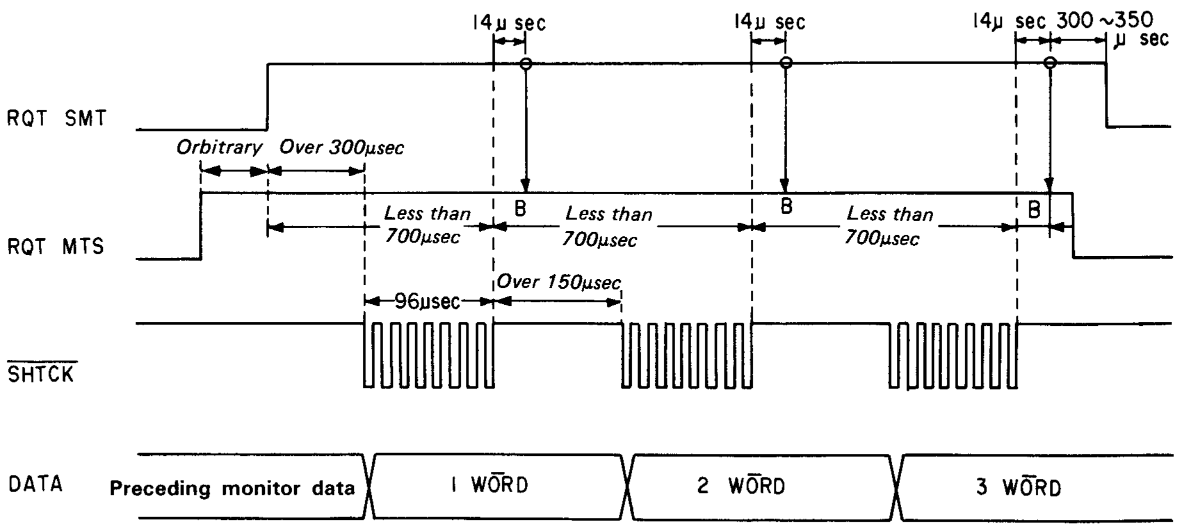


Fig. 8-5.

(2) Transfer interrupted:

Serial data transfer is interrupted in the following cases:

1 Interruption by system control:

After RQT MTS = H is displayed after RQT SMT = ⎍, unless the system control finishes the 8-bit transfer within 700 μsec. Unless the system control finishes the 8-bit transfer of the second, and third word within 700 μsec after the preceding transfer is completed.

2 Timer interruption:

In the case when remote control interruption is received before the display of RQT SMT = H, with RQT MTS = H, the priority is given to the remote control process.

In the case of RQT SMT = H with RQT MTS = H, even if the remote control interruption is received, the transfer is continued, confirms the remote control interruption at the end of the transfer, and, if no interruptions exist,the process is closed.

If an interruption exists, the remote control process will be carried out.

8-3. SERIAL DATA TRANSFER BETWEEN MAIN TIMER CPU AND SUB-TIMER CPU:

Data transfer is carried out by means of the main timer CPU and the sub-timer CPU through the 8-bit serial port.

Five data lines are required, i.e., MCLK, SUBDATA, MAINDATA, REQ-SM and REQ-MS.

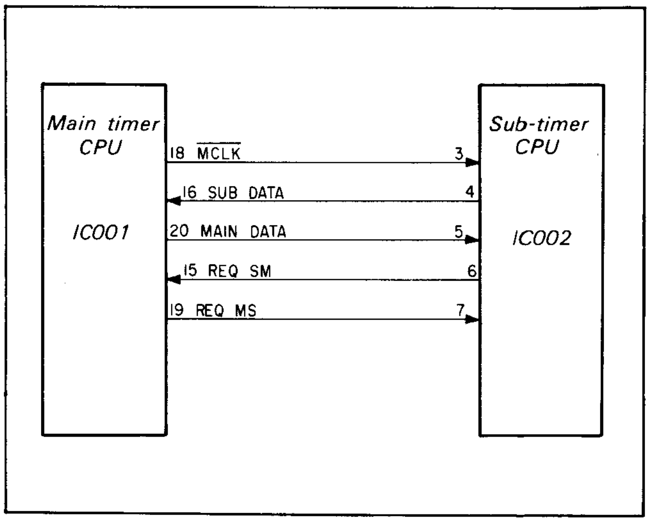


Fig. 8-6.

(1) Data transfer request:

There are two types of data transfer request, i.e., the main timer CPU request and the sub-timer CPU request.

1 Main timer request:

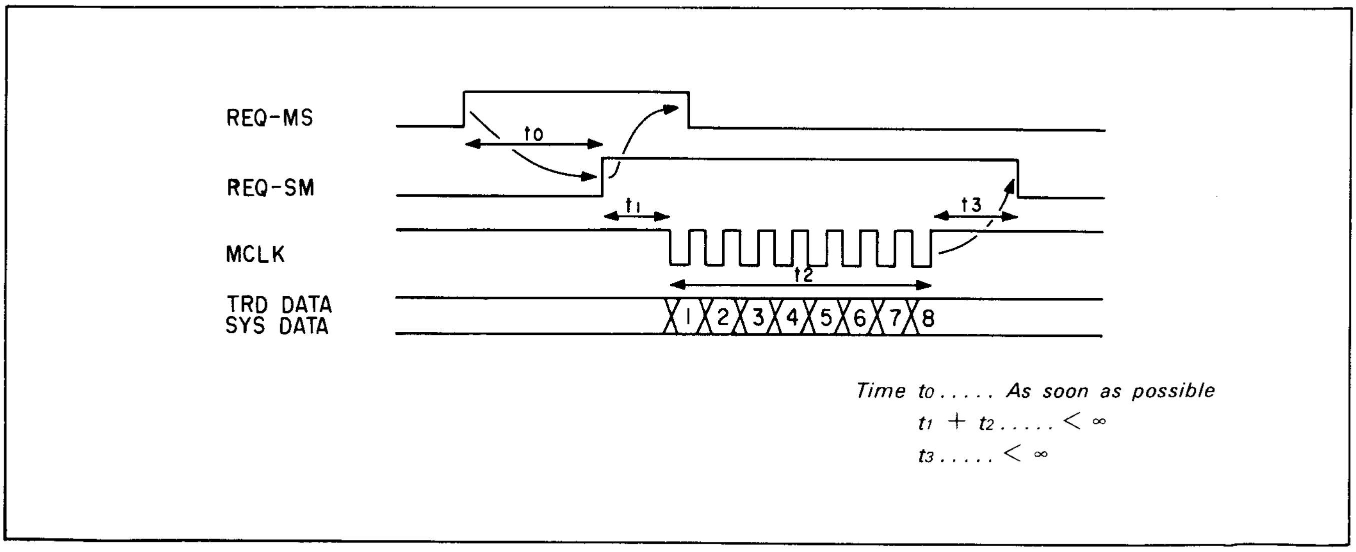


Fig. 8-7.

2 Sub-timer request:

Same as case 1 , except in the case where REQ MS = "H".
In such a case, internal request leads to REQ SM = H.

(2) Transfer interrupted:

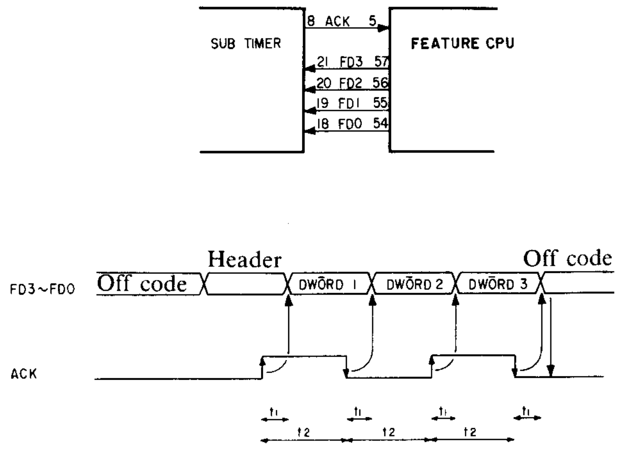
Transfer is not interrupted.

8-4. DATA TRANSFER BETWEEN SUB-TIMER CPU AND FEATURE CPU:

The sub-timer CPU receives from Feature CPU (PC-15B board IC001) the serial data transfer and obtains the following display data:

1. Remaining data on the tape.
2. PCM ID data:
   Stereo, Bilingual.

Data transfer is carried out through the 5-bit (Data: 4 bits. Control: 1 bit) parallel port.



- Timer
  t1<3 to 4 msec
  max t1=4 msec
- ACK is reversed immediately after the data reception.
- In the case of off-code, unconditionally ACK = L. Preceding data should be ignored.

Note) There is no transfer in the POWER OFF.

Fig. 8-8.

8-5. KEY SCAN:

Majorities of timer-reservation and clock-related keys (buttons) have been incorporated in matrices. Pressure on keys leads to the output of KOUT1—KOUT3 signals from the sub-timer CPU (IC002) in the timing illustrated in Fig. 8-8, causing the key matrices to scan. Table. 8-3 shows the key matrices, where KOUT line 4 will scan only once when the operation starts following the initial reset of timer CPU (IC 001 and IC 002) at the end of a long current failure.

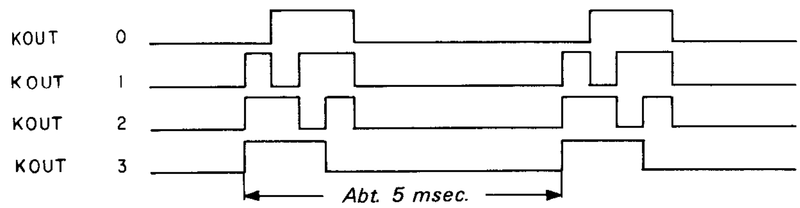


Fig. 8-9.

	KIN 3 ⑰	KIN 2 ⑯	KIN 1 ⑮	KIN 0 ⑭
K OUT 0 ㊸	CLOCK SET	KEY SELECT	TIMER REC ON/OFF	QUICK TIMER
K OUT 1 ㊹	COUNTER PRESET (TIMER CHECK)	TV/VTR (NEXT)	TAPE RETURN (TIMER SET)	LP/SP
K OUT 2 ㊺	−	+	NOTHING	INPUT SELECT
K OUT 3 ㊻	X2	SLOW	STEP	CLOCK/COUNTER
K OUT 4 ㊽	NOTHING			J/AEP, UK

Table 8-3

8-6. FIP (FLUORESCENT DISPLAY TUBE) DRIVE:

The FIP (Fluorescent display tube) is directly operated by means of the main timer CPU (uPD5719HG) and the sub-timer CPU (uPD7519HG), whose drive systems are shown in Fig. 8-10, and whose display matrices are indicated in Tables 8-4 and 8-5.

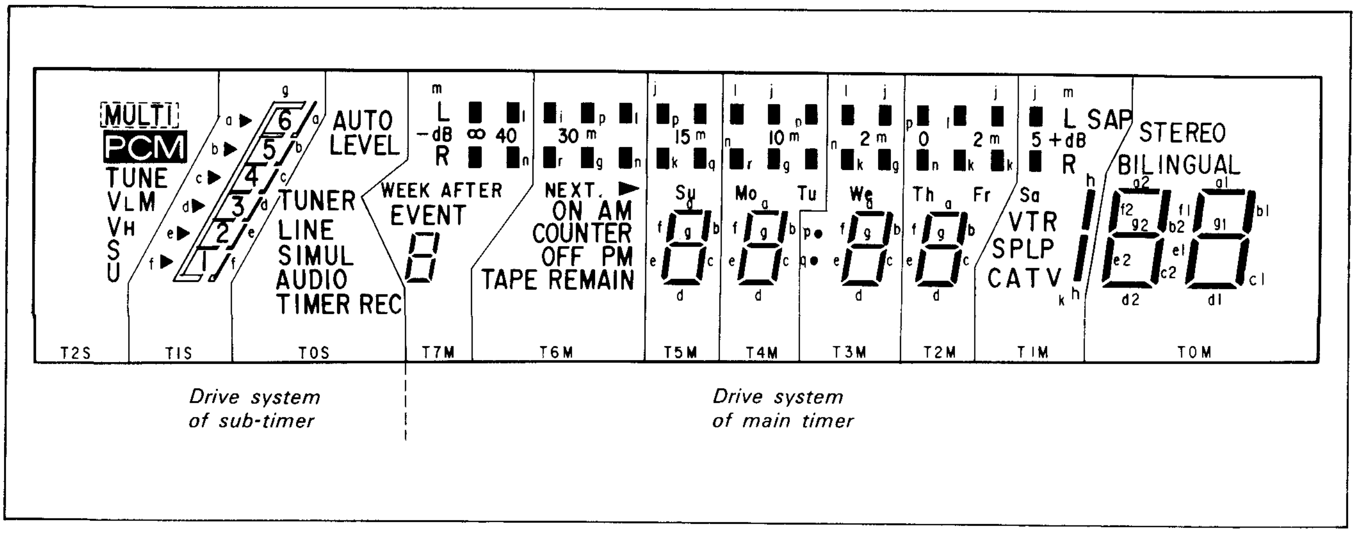


Fig. 8-10.

		S0M	S1M	S2M	S3M	S4M	S5M	S6M	S7M	S8M	S9M	S10M	S11M	S12M	S13M	S14M	S15M
		IC001 ㉞	IC001 ㉝	IC001 ㉜	IC001 ㉛	IC001 ㉚	IC001 ㉙	IC001 ㉘	IC001 ㉗	IC001 ㊷	IC001 ㊶	IC001 ㊵	IC001 ㊴	IC001 ㊳	IC001 ㊲	IC001 ㊱	IC001 ㉟
T0M	IC001 ㊿	a1	b1	c1	d1	e1	f1	g1	STE-REO	a2	b2	c2	d2	e2	f2	g2	BILIN-GUAL
T1M	IC001 ㊾	Sa	h	LP	CATV	SP		VTR	m	SAP			k				j
T2M	IC001 ㊽	a	b	c	d	e	f	g	m	Fr	q	n	k	Th	p	l	j
T3M	IC001 ㊼	a	b	c	d	e	f	g	m	q	p	n	k	We		l	j
T4M	IC001 ㊻	a	b	c	d	e	f	g	m	Tu	n	k	q	Mo	l	j	p
TM5	IC001 ㊺	a	b	c	d	e	f	g	m	>	<	k	g	Su		j	p
T6M	IC001 ㊹	NEXT ▶	AM	PM	TAPE REMAIN	OFF	ON	COUN-TER	m		k	q	n		j	p	l
T7M	IC001 ㊸	a	b	c	d	e	f	g	m		WEEK AFTER		n		EVE-NT		l

Table 8-4. Main Timer CPU Display Matrices

		S0S	S1S	S2S	S3S	S4S	S5S	S6S	S7S	S8S	S9S	S10S	S11S	S12S	S13S	S14S	S15S
		IC002 ㉞	IC002 ㉝	IC002 ㉜	IC002 ㉛	IC002 ㉚	IC002 ㉙	IC002 ㉘	IC002 ㉗	IC002 ㊷	IC002 ㊶	IC002 ㊵	IC002 ㊴	IC002 ㊳	IC002 ㊲	IC002 ㊱	IC002 ㉟
T0S	IC002 ㊿	TUNER	LINE	SIMUL	AUDIO	TIMER	REC	AUTO LEVEL									
T1S	IC002 ㊼	a	b	c	d	e	f	g		a ▶	b ▶	c ▶	d ▶	e ▶	f ▶		
T2S	IC002 ㊽									PCM	V_L			U	V_H	TUNE	MULTI

Table 8-5. Sub-timer CPU Display Matrices

8-7. AUDIO LEVEL DETECTION:

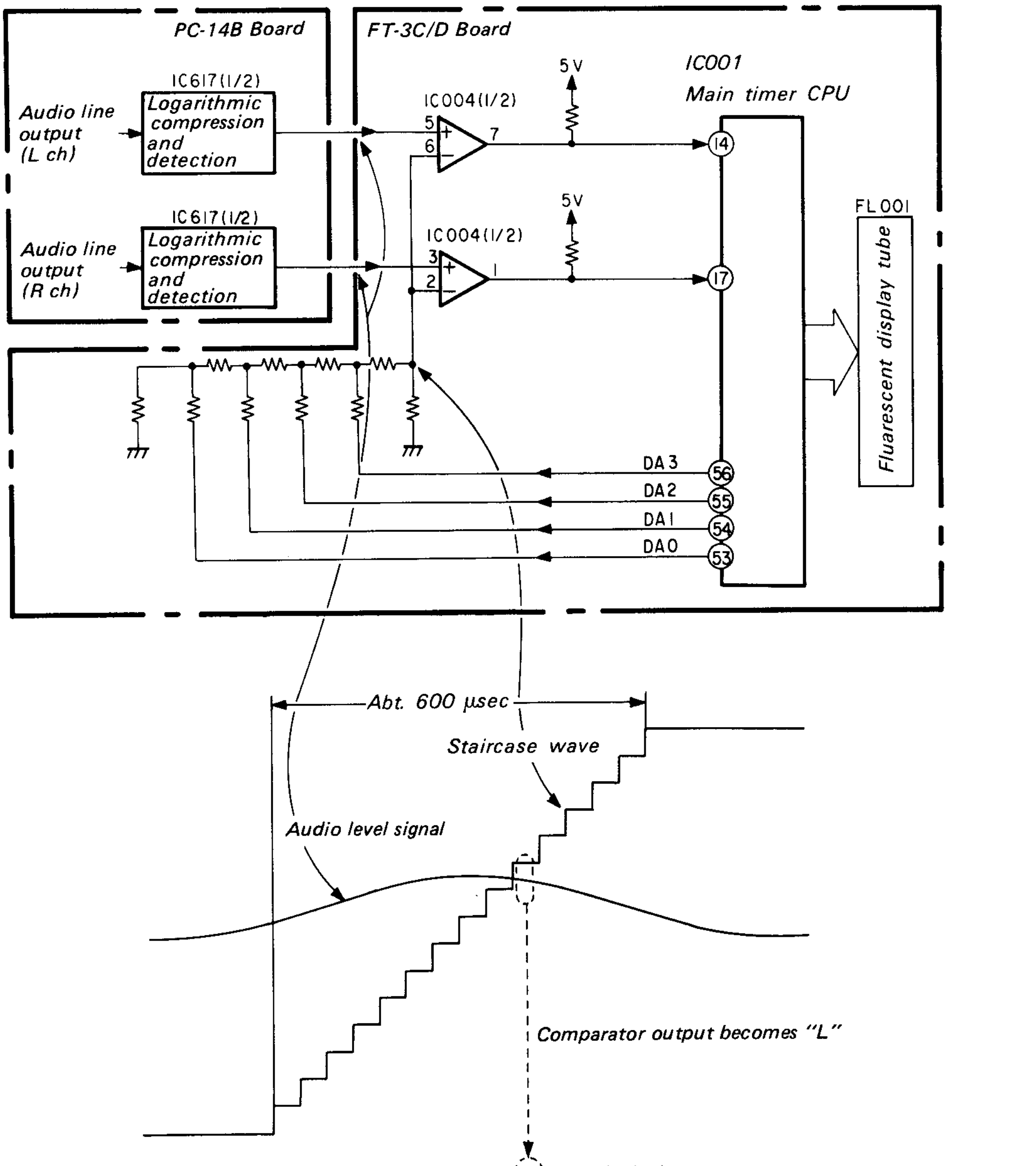
Audio level detection and display are carried out exclusively by the main timer CPU (IC001).

Positive input pin ⑤ and pin ③ of comparator IC004 are input respectively with L- and R-channel audio level signals. Those audio level signals are found by detection and logarithmic-compression of the audio line output siganl in PC-14B board IC617.

Negative input pin ⑥ and pin ② of comparator IC004 are input with analog voltage (staircase wave) obtained by D-A converting the 4-bit digital output DA0–DA3 (Fig. 8-11).

If the staircase wave voltage gradually rises from 0V dc and over the audio level signal voltage. The comparator output becomes "L". When it cecomes "L", the value of IC001 digital output DA0–DA3 is taken as the audio level display data. The period over which the audio level is detected is abt. 12 msec.

Pin ⑦ and Pin ① of comparator IC004 are respectively connected with Pin ⑭ and Pin ⑰ of IC001. The comparator output enables the main timer CPU to detect the audio signal level.



DA3	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
DA2	0	0	0	0	1	1	1	1	0	0	0	0	0	1	1	1	1
DA1	0	0	1	1	0	0	1	1	0	0	1	1	1	0	0	1	1
DA0	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0

Fig. 8-11.

8-8. INFRARED REMOTE CONTROL SIGNAL AND CONTROL S SIGNAL INPUT CIRCUIT.

The infrared remote control signal is received by the photodiode on PD-11 board D001 and input into light reception pin ① of IC005. SIRCS signal is demodulated in IC005 and input through R087 into pin ② and pin ㊲ of sub-timer CPU IC002, and then into the sub-timer CPU through SS-38F/G board Q137 and D109 (1/2). When actually a signal is received by Control S input, Q107 is turned on through D109 (1/2) R175. Turning Q107 on pulls up pin ② and pin ㊲ of IC002 in 1K of R173, and, even if the infrared remote control output IC005 pin ⑦ is "L", since it runs through R087 (27K), Pin ② and Pin ㊲ of IC002 fail to become "L", and therefore input of the infrared remote control signal is prohibited.

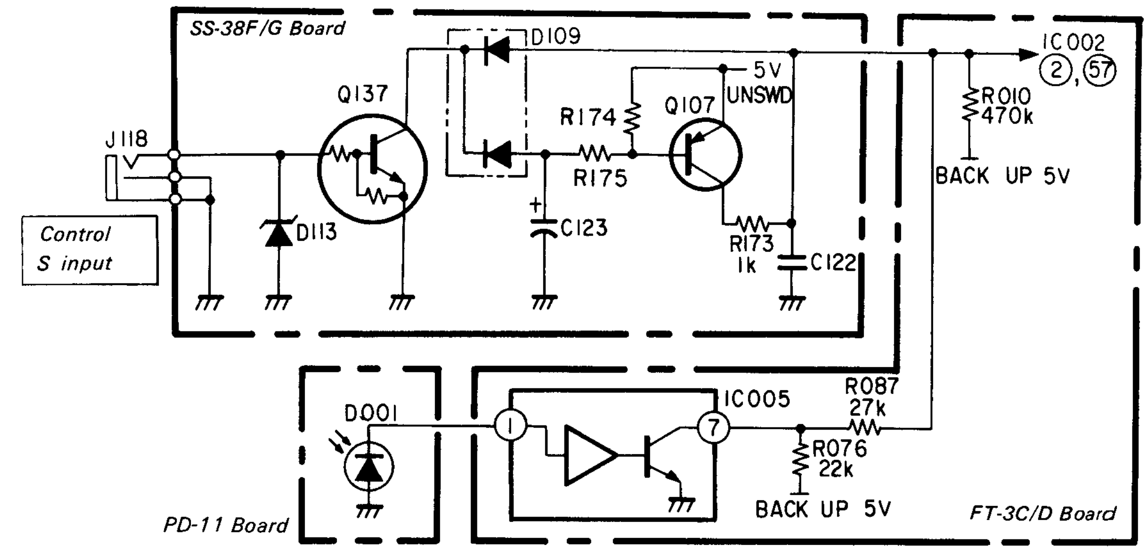


Fig. 8-12.

8-9. POWER ON/OFF CONTROL:

Power on/off control is operated by the four following inputs to the sub-timer CPU (IC003):

(1) Power SW signal which is input into pin ⑫ of the sub-timer CPU (IC002) from Power ON/Off Switch (S301) of PW-9A board.

(2) Infrared remote control signal which is input into pin ② and pin ㊲ of the sub-timer CPU (IC002) through substrate FT-3C/D IC005 after being received by D001 of PD-11A board.;

(3) Control S signal which is input into pin ② and pin ㊲ of the sub-timer CPU from the control S input terminal of SS-38F/G board is performed in the same manner as in the case of the remote control signal.

(4) Power On/Off during the timer picture recording by means of program stored in the memory within the sub-timer CPU using the key matrix input.

The main Main timer CPU (IC001) is responsible for the power on/off control. If the $\overline{\text{POWER ON}}$ signal in pin ㊷ of the main timer CPU is prepared in "L". IC301 in power PS-86A board is actuated and the power supply is turned on.

8-10. CPU RESET:

Each CPU is actuated by means of the power supply shown in Table 8-6:

	BACKUP5V	UN5V	REG5V
Main timer CPU	o		
Sub-timer CPU	o		
System control CPU		o	
Emergency CPU		o	
Servo CPU		o	
Feature CPU			o
Shift CPU			o

Table 8-6.

Backup 5V and UNS 5V are the power supplies which are always in output, as long as AC plug is plugged into the receptacle. In current failure, the BACKUP 5V only is output so that the timer back-up is ensured. REG 5V is output only during the power supply is ON.

It is necessary to reset each CPU rising of its power supply.

The main timer CPU and the sub-timer CPU are re-set by means of the reset circuit (hard rest circuit) on SS-38F/G board.

When the main timer CPU is reset and actuated, and, in the case of current failure, the main timer CPU is responsible for the reset of each of the CPUs using UNS 5V as the power supply (Soft Reset).

Subsequently, when the POWER push-button is depressed, the sub-timer CPU causes the main timer CPU to turn the current on to each CPUs which are powered by REG 5V. The reset action is a soft reset following the program incorporated in the CPU.

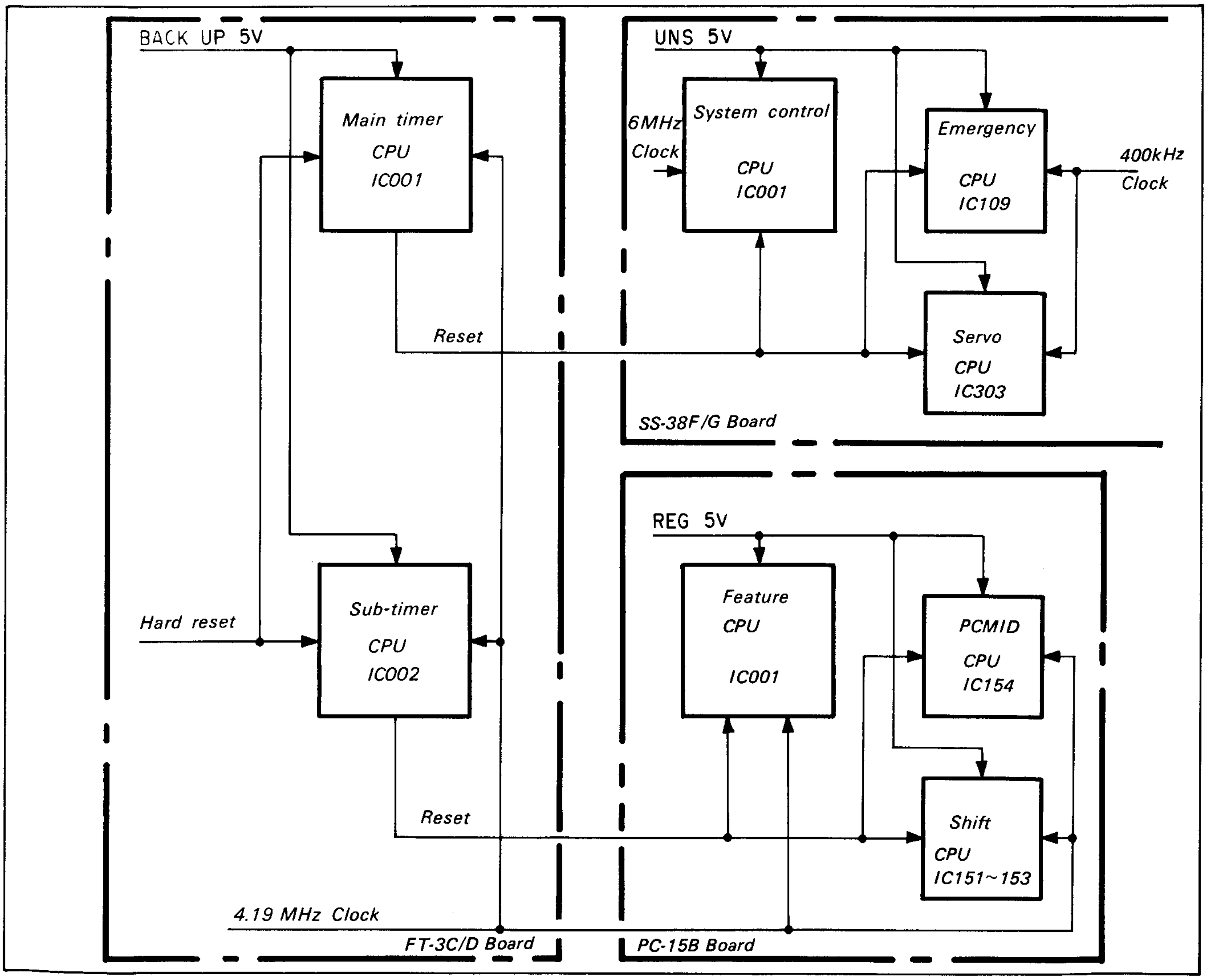


Fig. 8-13.

SECTION 9
EXPLANATION OF MECHANICAL OPERATION

9-1. MAIN PARTS OF MECHANISM AND PARTS ARRANGEMENT

9-1-1. Automatic identification mechanism of 8 m/m Video

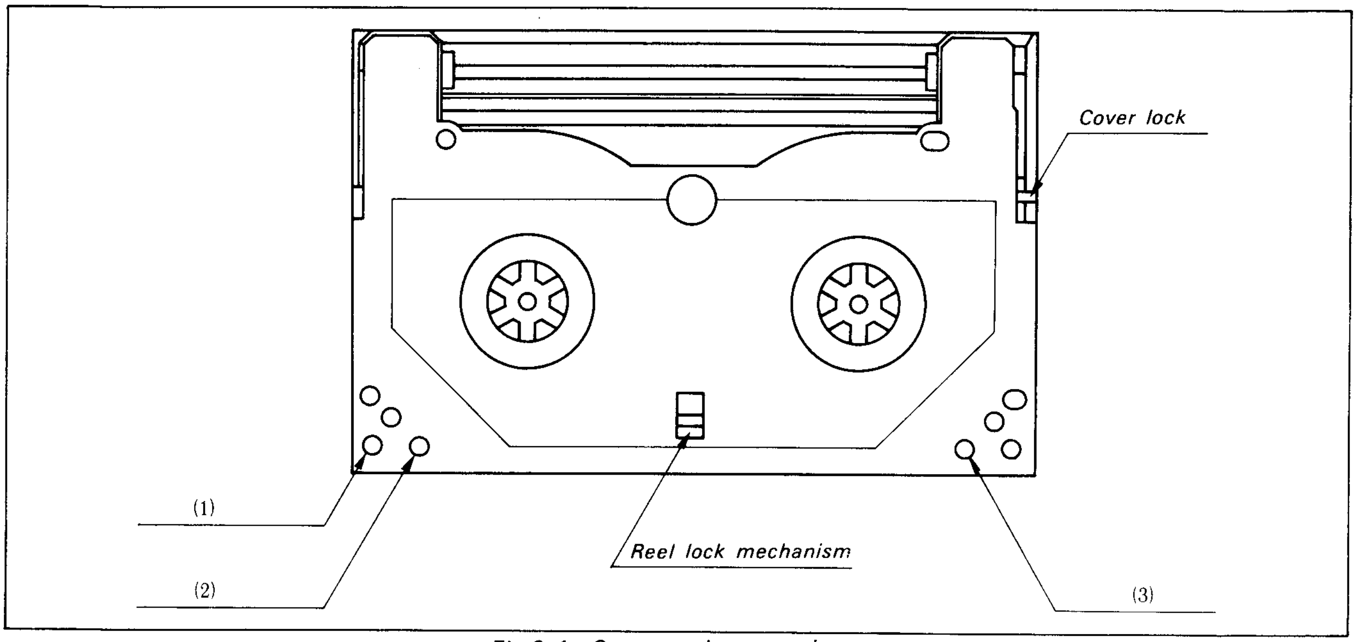


Fig.9-1. Cassette bottom view

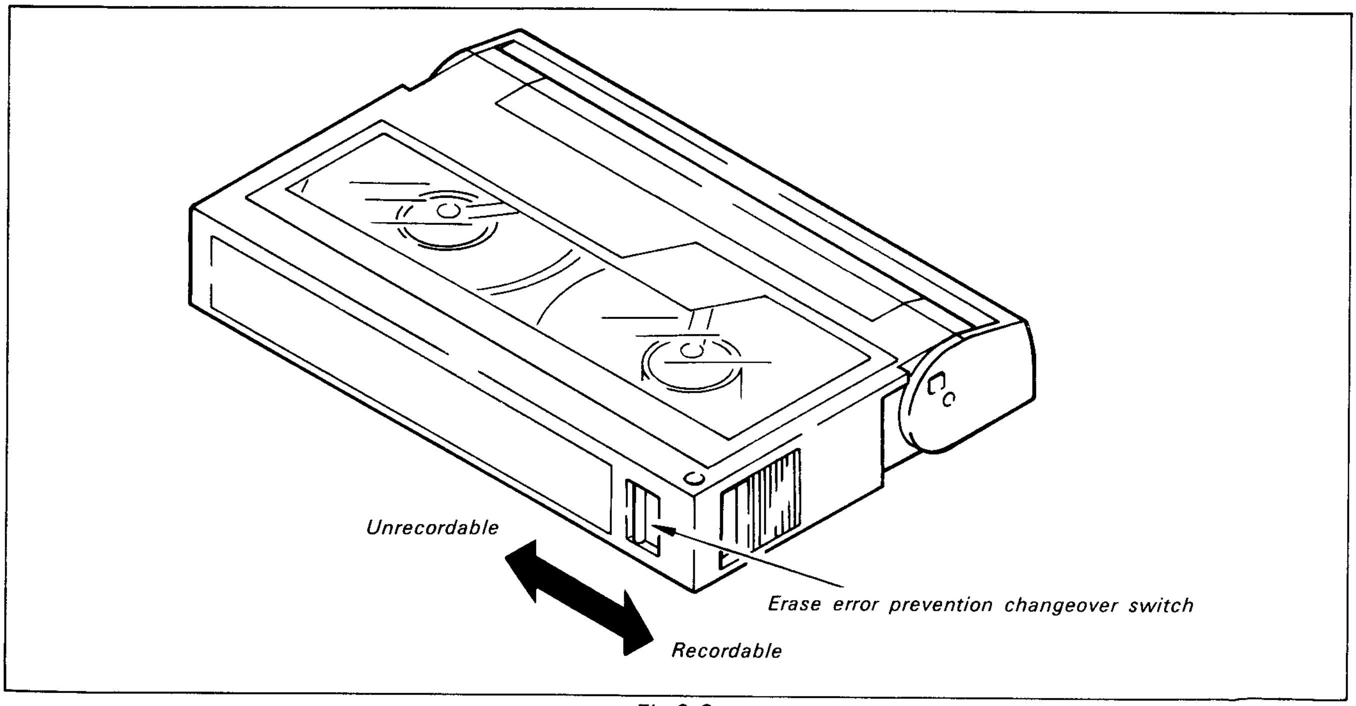


Fig.9-2

Object		Close	Open
(1)	Erase error	REC Recordable	REC Unrecordable
(2)	Tape type	Type A (MP Tape)	Type B (ME Tape)
(3)	Tape thickness	13 μm Tape	10 μm Tape

Table. 9-1.

9-1-2. L-SW

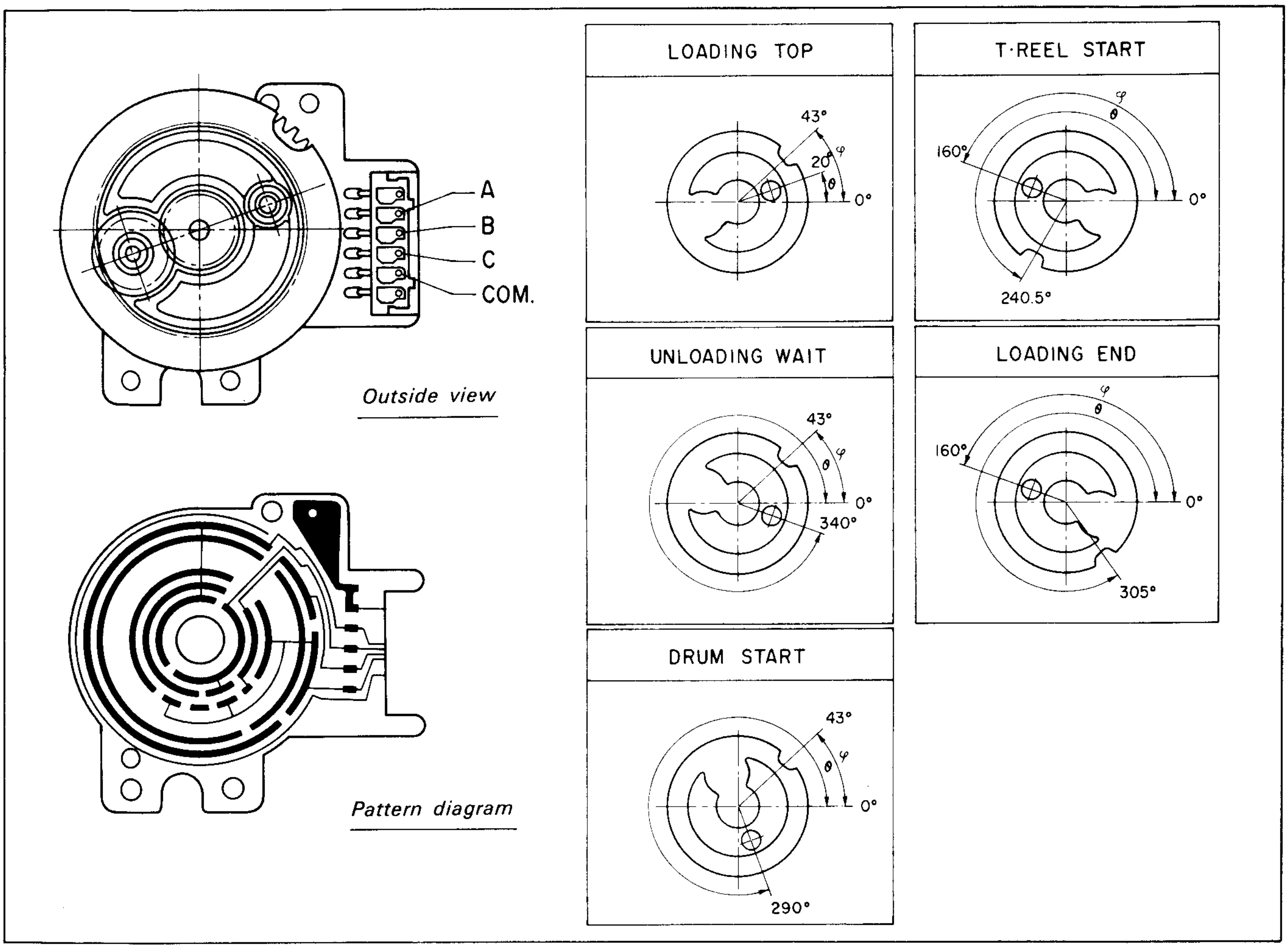


Fig. 9-3.

MODE	θ	φ	Output signal pattern			HEX	Pass time in msec
			A	B	C		
LOADING TOP	10° to 30°	43°±5° (fixed)	1	0	0	1	—
BLANK	↓		1	1	1	7	
UNLOADING WAIT	330° to 350°	43°±5° (fixed)	1	0	1	5	140
BLANK	↓		1	1	1	7	
DRUM START	280° to 300°	43°±5° (fixed)	0	0	1	4	140
BLANK	↓	↓	1	1	1	7	
T.REEL START	160°±5° (fixed)	275° to 290°	0	1	1	6	100
BLANK		↓	1	1	1	7	
LOADING END	160°±5° (fixed)	345° to 375°	1	1	0	3	—
			0: COM and short 1: COM and open				L motor terminal voltage 4.3V±0.3V

Note:
- The position code must be fixed in the regions designated by θ, φ
- The code between positions must be fixed at (1, 1, 1)

Table 9-2. L-SW position code table

9-1-3. M-SW

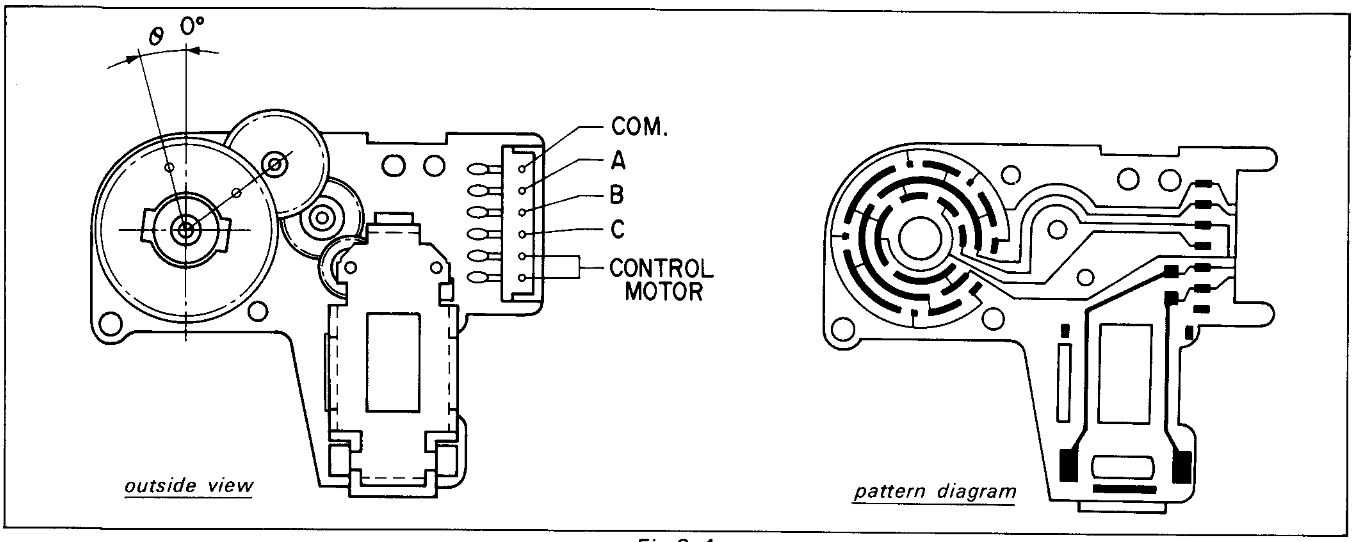


Fig.9-4.

MODE	θ	Output signal pattern A	B	C	HEX	Time required for passing each mode in msec
EJECT	4°51' to 18°21'	0	0	1	4	—
BLANK	↓	1	1	1	7	
LOADING/UNLOADING	61°57' to 67°57'	0	1	0	2	60
BLANK	↓	1	1	1	7	
FF/REW	111°33' to 117°33'	0	1	1	6	60
BLANK	↓	1	1	1	7	
STOP	190°57' to 196°57'	1	1	0	3	100
BLANK	↓	1	1	1	7	
FWD	277°45' to 283°45'	1	0	0	1	60
BLANK	↓	1	1	1	7	
RVS	327°21' to 340°21'	1	0	1	5	—
	Tolerance ±1°	0: COM and short 1: COM and open				Control motor terminal voltage 4.3V±0.3V

Table. 9-3. M-SW position code table

9-1-4. How to identify mode position of M slider

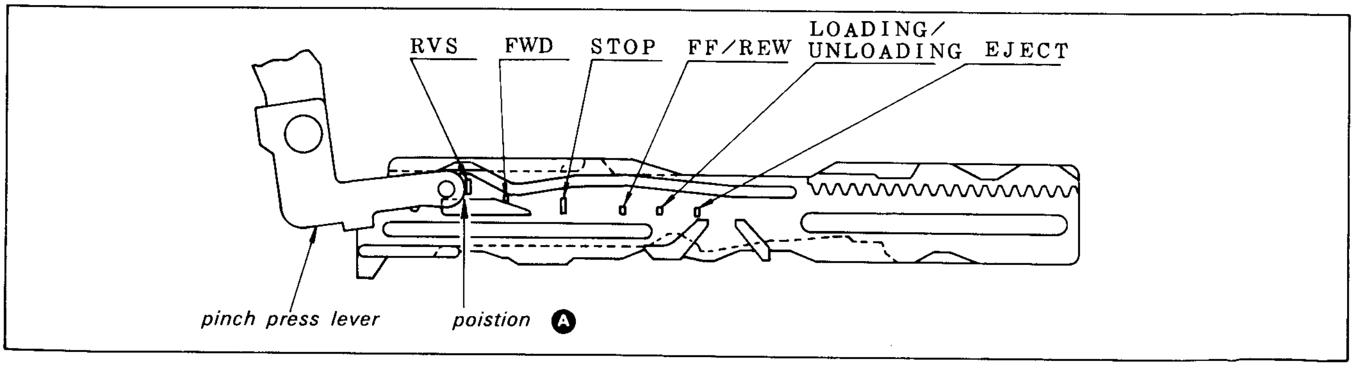
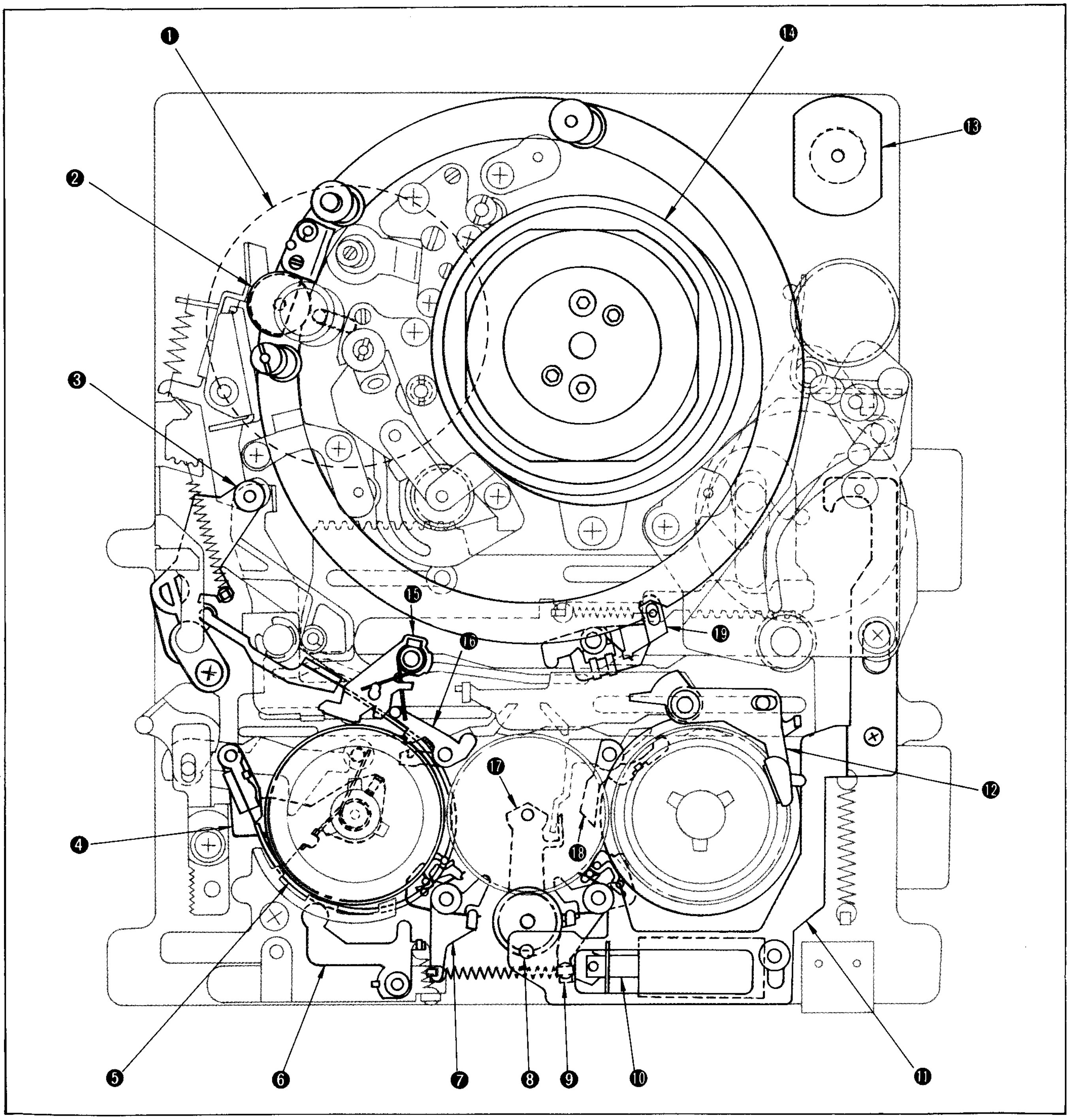


Fig. 9-5.

It is possible to identify the position of each M slider mode by confirming that the position Ⓐ of pinch press lever coincides with each mode position on the M slider, only when LED base assembly is demounted.

9-1-5. Relative arrangements of motor, solenoid and brake



❶ CAPSTAN MOTOR
❷ Pinch roller
❸ Tension regulator arm
❹ Tension regulator fixed end
❺ Tension regulator band
❻ FF BRAKE (S soft brake)
❼ S-MAIN BRAKE
❽ Release pin of lock slider
❾ T-MAIN BRAKE
❿ BRAKE SOLENOID
⓫ Lock slider
⓬ T-SOFT BRAKE
⓭ LOADING MOTOR
⓮ DRUM MOTOR
⓯ REV BRAKE
⓰ S-HARD BRAKE
⓱ Drive arm
⓲ REW BRAKE
⓳ Ring lock arm

		EJECT	LOADING/ UNLOADING	FF/REW	STOP	FWD	RVS
1	DRUM MOTOR	OFF	ON	ON	OFF	ON	ON
2	CAPSTAN MOTOR	OFF	ON	ON	OFF	ON	ON
3	LOADING MOTOR	OFF	ON	OFF	OFF	OFF	OFF
4	BRAKE SOLENIID	ON	ON	ON	OFF	OFF Note	ON
5	S.T. MAIN BRAKE	OFF	OFF	OFF	ON	OFF	OFF
6	T-SOFT BRAKE (T side)	ON	ON	OFF	ON	OFF	ON
	REW BRAKE (T side)	OFF	ON	ON	OFF	OFF	ON
	S-HARD BRAKE (S side)	ON	ON	OFF	ON	OFF	OFF
	FF BRAKE (S side)	OFF	OFF	ON	OFF	OFF	OFF
	REV BRAKE (S side)	OFF	OFF	OFF	OFF	OFF	ON
	TENSION REGULATORBAND	—	—	—	—	PRESS	—
7	TENSION REGULATOR ARM	IN	OUT/IN	FIXED	STOP position	FWD position	FIXED
	TENSION REGULATOR-FIXED END	LOCK	LOCK	RELEASE	RELEASE	LOCK	CANCEL
8	DRIVE ARM	FREE	FREE	FREE	LOCK	FREE	FREE
	VERTICAL SWITCH OF DRIVE ARM	UP	UP	DOWN	UP	UP	UP
9	RING LOCK	RELEASE	RELEASE	LOCK	LOCK	LOCK	LOCK
10	PINCH ROLLER	RELEASE	RELEASE	RELEASE	RELEASE	PRESS	PRESS
11	CASSETTE COMPARTMENT	RELEASE	LOCK	LOCK	LOCK	LOCK	LOCK
12	REEL LOCK	LOCK	Driven by lock slider release pin	RELEASE	RELEASE	RELEASE	RELEASE

Note: Turned on at blank portion to shift from STOP to FWD.
Turned off when FWD is entered.

Table 9-4. Mode transition table

9-2. EXPLANATION OF MECHANICAL OPERATION

9-2-1. CASSETTE IN

When the power is turned on, and the EJECT button is depressed, cassette compartment turns up.
Upon insertion of cassette, the claw ❶ of the cassette compartment releases the lock ❷ of the cassette cover to make ready for open or close. When the cassette is pushed in further, along arrow Ⓐ, lock slider ❸ moves in the direction of arrow Ⓑ, and the cassette compartment lock sw ❹ is pushed along direction Ⓒ to turn on.
A top or end sensor regards "cassette in" over when any one of ① to ③ in Table 9-5 is detected. (Unless cassette in, both top and end sensors are "H".) (See Fig. 9-7.)

	TOP (T side)	END (S side)
①	(H)	(L)
②	(L)	(H)
③	(L)	(L)

Table. 9-5.

H: Sensor receiving light
L: Sensor not receiving light

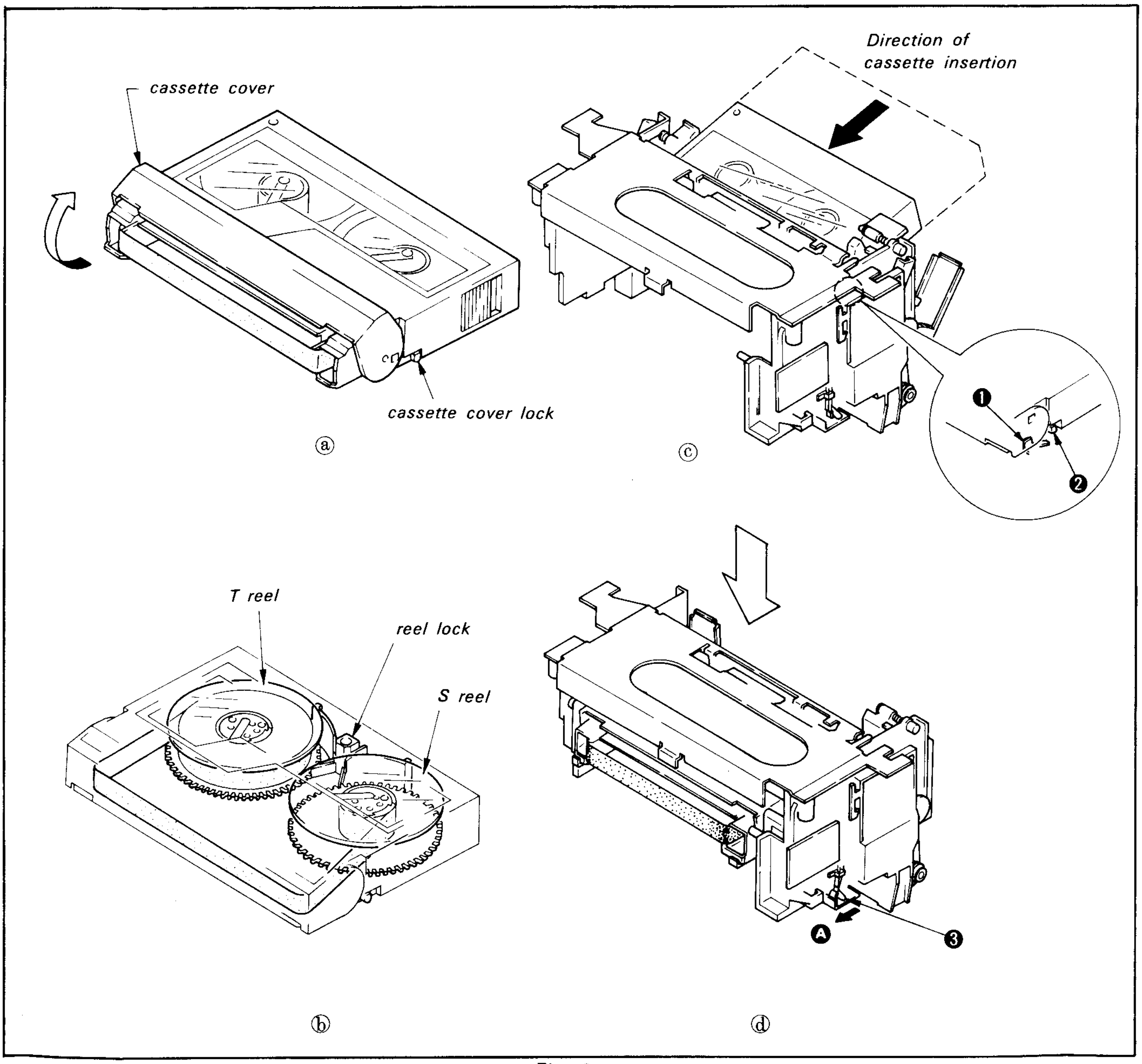


Fig. 9-7.

9-2-2. DONE → THREADING

Upon detection of CASSETTE IN in 9-2-1 above, the drum motor ❶ is started in the direction of arrow. (In DOWN state, main brake solenoid ⓱ is turned on, and both S main brake ⓳ and T main brake ⓴ are released. Also, mode slider is normally positioned at LOADING/UNLOADING.)
Next, capstan motor ❷ rotates in the direction of arrow Ⓐ. At the same time, the turning effort is transmitted to the drive gear A ❸ of the general drive assembly by the timing belt, so that the drive gear B ❹ in mesh with it is turned to bite into the gear above the S reel base ❺, thus transmitting the turning effort of capstan motor ❷ to the S reel base ❺. This is to prevent drive gear B ❹ from coming into contact with T reel base when sledding.
At the same time, L motor ❻ is started, and the lock slider ❼ moves in direction of arrow Ⓑ, and the reel lock in the cassette is released, making it possible to take out tape.
When L slider ❽ moves in the direction of arrow Ⓒ, the tension regulator load arm ❾ moves, whereby tension regulator arm ❿ is driven in the direction of arrow Ⓓ.
At the same time, the No.2 drive gear ⓫ urges the No.2 guide ⓬ and slant guide block ⓭ in the direction of arrow Ⓔ.

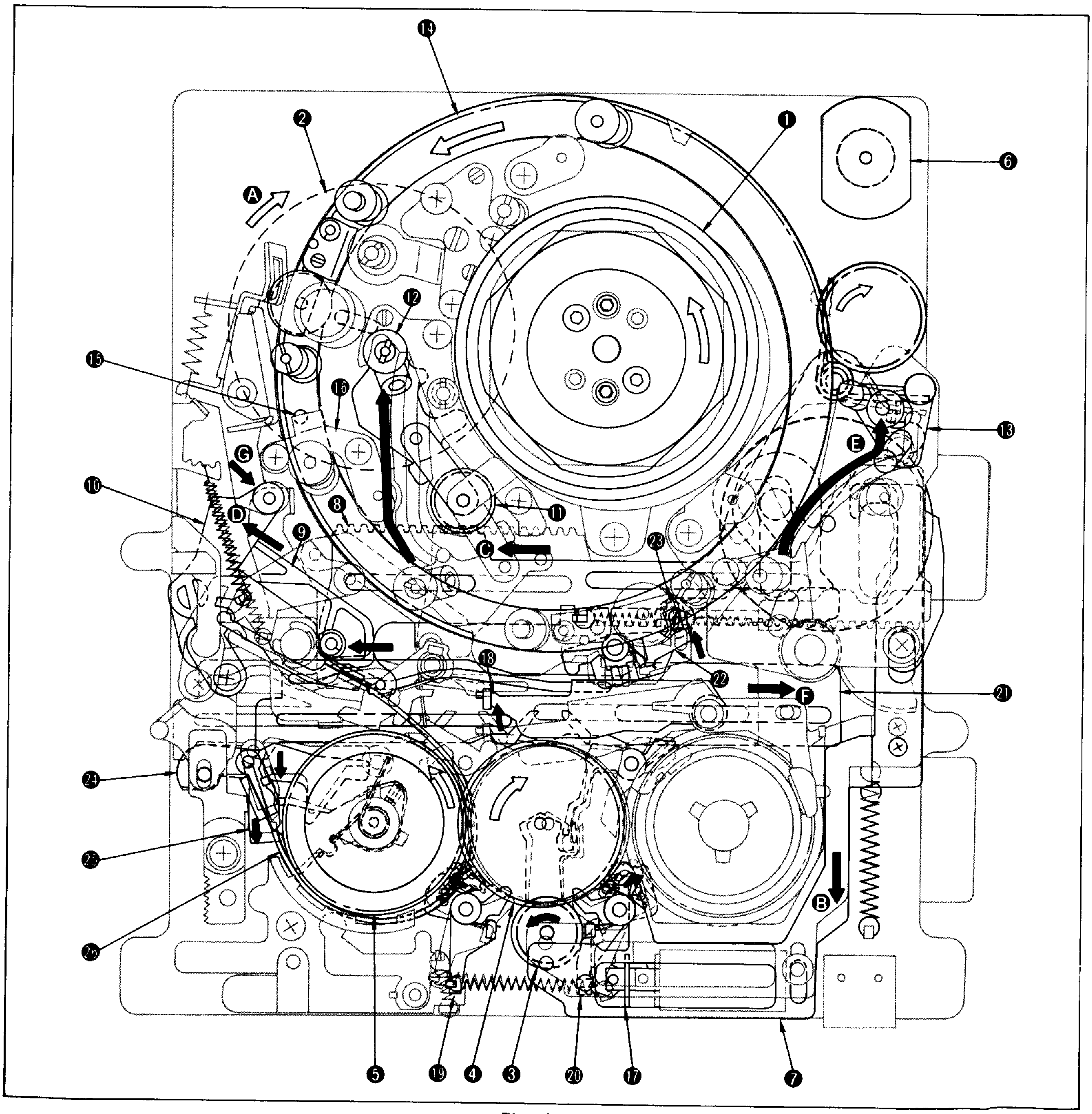


Fig. 9-8a.

and presses them in position, thus completing the arm threading. Under this condition, the threading ring ⑭ rotates in the direction of arrow, winding the tape on drum ❶. And a protrusion ⑮ on the ring comes into contact with ring stopper ⑯ on the chassis, and when it comes to position, the ring threading a is completed.

The turning off of brake solenoid ⑰ drives the B cancel slider and the B cancel arm ⑱, so that brake is applied to both T and S reel bases by S main brake ⑲ and T main brake ⑳. Furthermore, the control motor is driven in the counterclockwise direction to set the mode switch from LOADING/UNLOADING to STOP. Upon moving of the M slider ㉑ in the direction of arrow Ⓕ, the cam action drives the ring lock arm ㉒ into a recess ㉓ in the threading ring, and preventing reverse rotation of the threading ring ⑭.

At the same time, tension regulator load arm ❾ operates to drive tension regulator arm ⑩ in the direction of arrow Ⓖ. On the other hand, the mode arm ㉔ urges band arm ㉕, followed by motion of tension regulator band ㉖ (in such a direction as to loosen the band), and when M slider ㉑ settles in STOP position, the threading is completed.

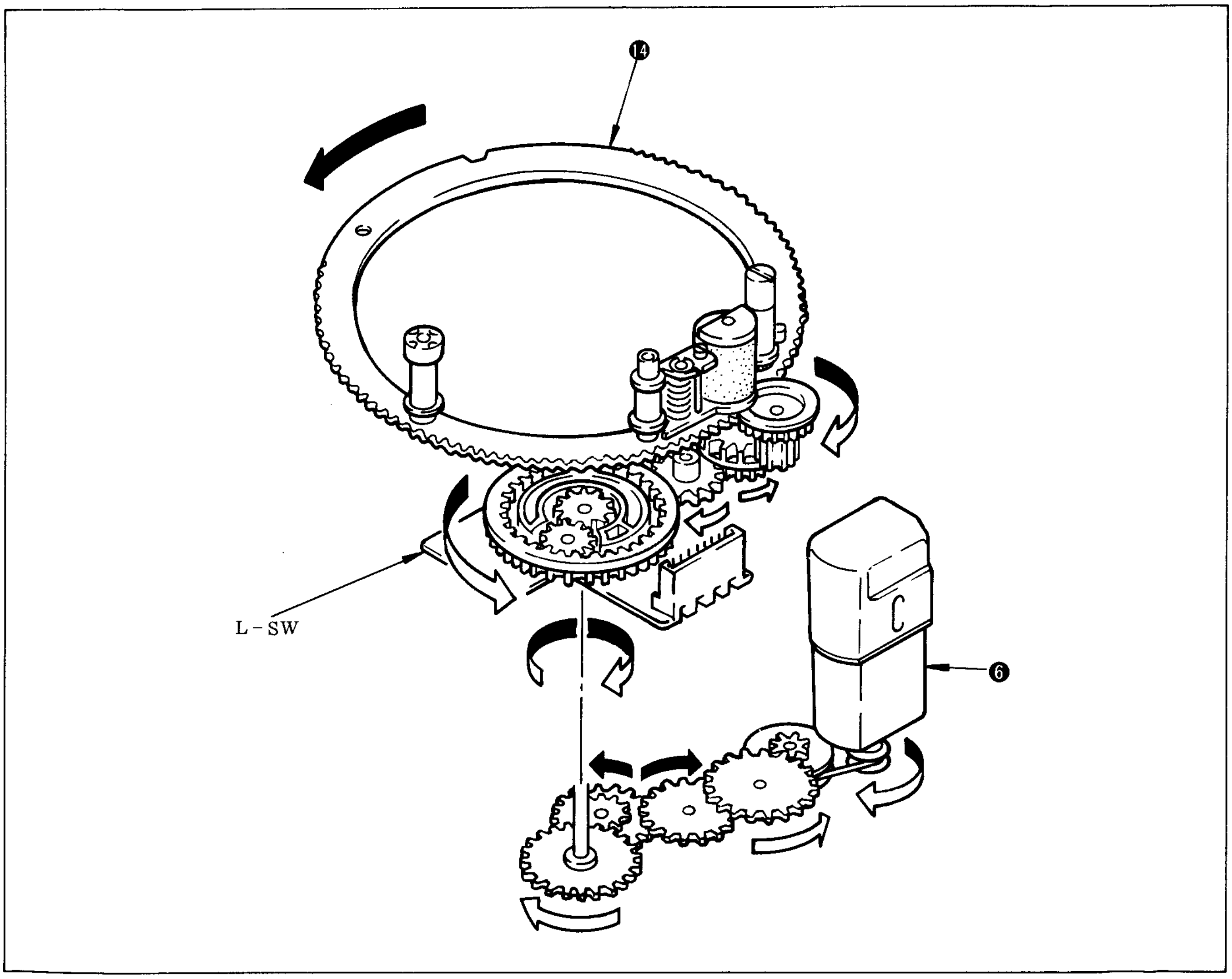


Fig. 9-8b.

Note: CCW: Counter clock wise
CW: Clock wise

9-2-3. TAPE PATH

The tape pulled out of the S reel ❶ in the cassette is first applied through No.1 guide ❷ of tension regulator arm, and through No.2 guide ❸, its angle of winding on drum ❺ is corrected, followed by being wound on drum ❺. Furthermore, the tape that has passed No.4 guide ❻ is corrected by No.5 guide ❼ for passing the capstan shaft ❽. It then passes between the pinch rollers ❾ pressed against the capstan shaft ❽, and its direction reversed by No.6 guide ❿ on the threading ring. Furthermore, the tape passes pinch roller ❾, No.7 guide ⓫ and No.8 guide ⓬ on the threading ring, and is changed greatly in direction by No.9 guide ⓭ and No.10 guide ⓮ on the slant guide block, being led into the cassette by No.11 guide ⓯ and wound on the T reel ⓰.

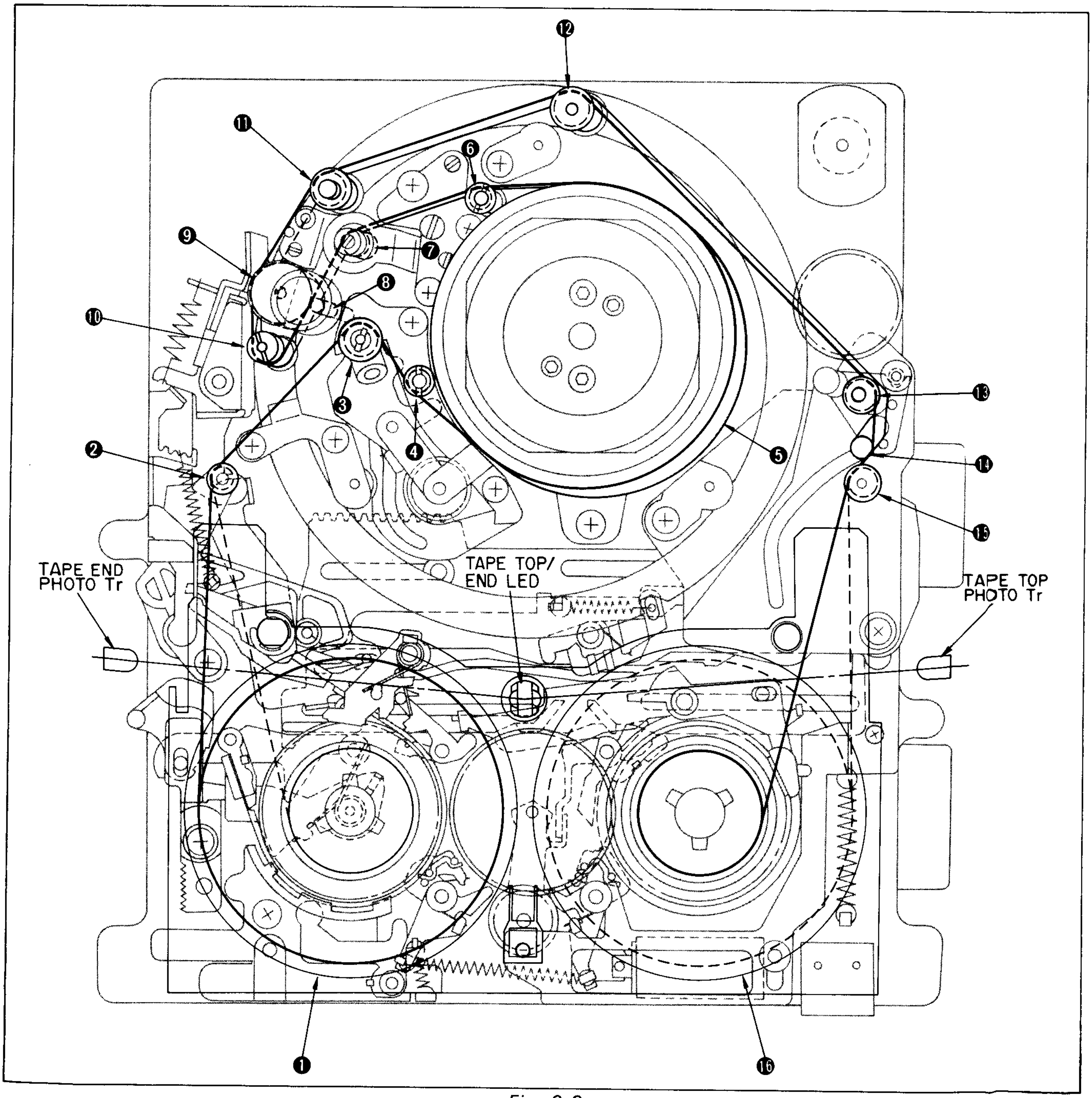


Fig. 9-9.

9-2-4. STOP to PB (REC)

When the PB (REC) button is depressed, the drum motor ❶ starts first of all. Then, the brake solenoid ❷ is turned on. (Turned on only during blank period from STOP to PB (REC), and after being transferred to PB (REC), brake solenoid is turned off). Also, the control motor is started to set M-SW into FWD (REC,PB,CUE) mode, so that the M slider ❸ is moved in the direction of arrow Ⓐ to FWD position. At this time, the cam of M slider ❸ turns off the T soft brake ❹ and S hard brake ❺. At the same time, mode arm ❻ moves band arm ❼, and tension regulator arm ❾ is also moved by tension regulator load arm ❽, thus moving tension regulator band ❿

Furthermore, the pinch press lever ⓫ drives pinch press arm ⓬, and thus presses the pinch roller ⓭ against the capstan shaft ⓮.
The release of the S main brake ⓯ and T main brake ⓰ is transmitted to B cancel arm ⓱ and B cancel slider. Under this condition, the brake solenoid ❷ fails to work but turns off. (Main brake is mechanically cancelled) Then, the capstan motor ⓲ is turned on, and rotates in the direction of arrow Ⓑ, while at the same time, the turning effort is transmitted by the timing belt to the drive gear A ⓳ of general drive assembly, and the rotation of drive gear B ⓴ in mesh therewith acts on the upper gear of the T reel mount ㉑, so that the T reel mount ㉑ is driven by the turning effort of the capstan motor ⓲.

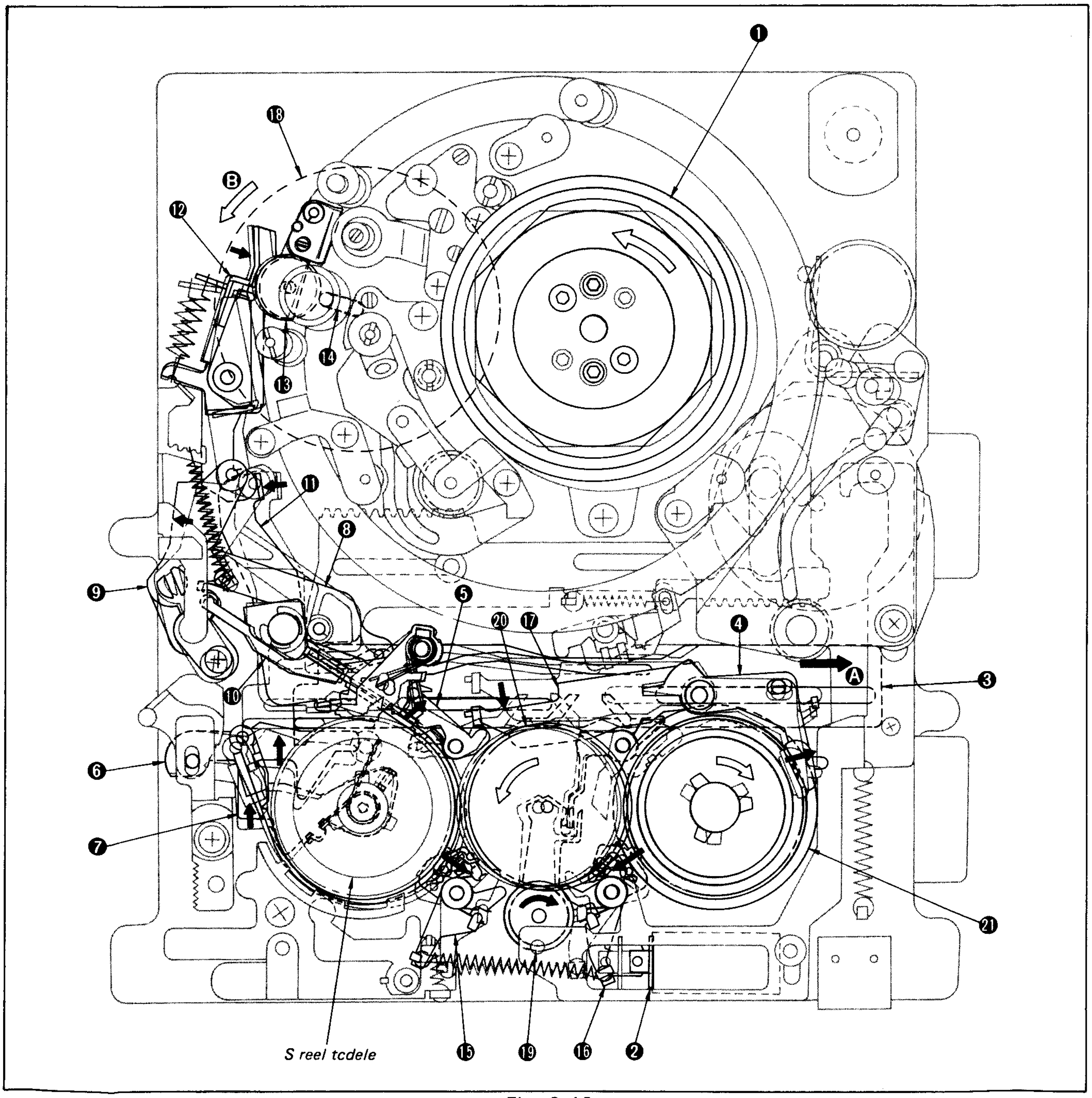


Fig. 9-10.

9-2-5. STOP to FF

Upon depression of FF button, the drum motor ❶ starts, and brake solenoid ❷ is energized. The control motor starts, setting M-SW into FF/REW mode. M slider ❸ is urged in the direction of arrow Ⓐ to FF/REW position. In the process, the cam of M slider ❸ turns on REW brake ❹ and S soft brake ❺, applying light torque to S and T reel mounts. At the same time, the T soft brake ❻ and S hard brake ❼ are turned off. By tension regulator load arm ❽, tension regulator arm ❾ and tension regulator band ❿ are moved further.
On the other hand, the release of S main brake ⓫ and T main brake ⓬ is transmitted from the B release arm ⓭ to B release slider. Under this condition, the brake solenoid ❷ is held on.
Furthermore, the vertical switching arm A ⓮ urges the vertical switching slider ⓯ and moves the drive gear B ⓲ at lower position so that the lower gear of T reel ⓱ is engaged by the vertical switching arm B ⓰ of the general drive assembly. Under this condition, the capstan motor ⓳ is turned on, and rotates in the direction of arrow Ⓑ. At the same time, the turning effort is transmitted by the timing belt to the drive gear A ⓴ of the general drive assembly, and by the rotation of the drive gear B ⓲ in mesh therewith, the lower gear of the T reel mount ⓱ is engaged, thus driving the T reel mount ⓱ by the turning effort of the capstan motor ⓳.

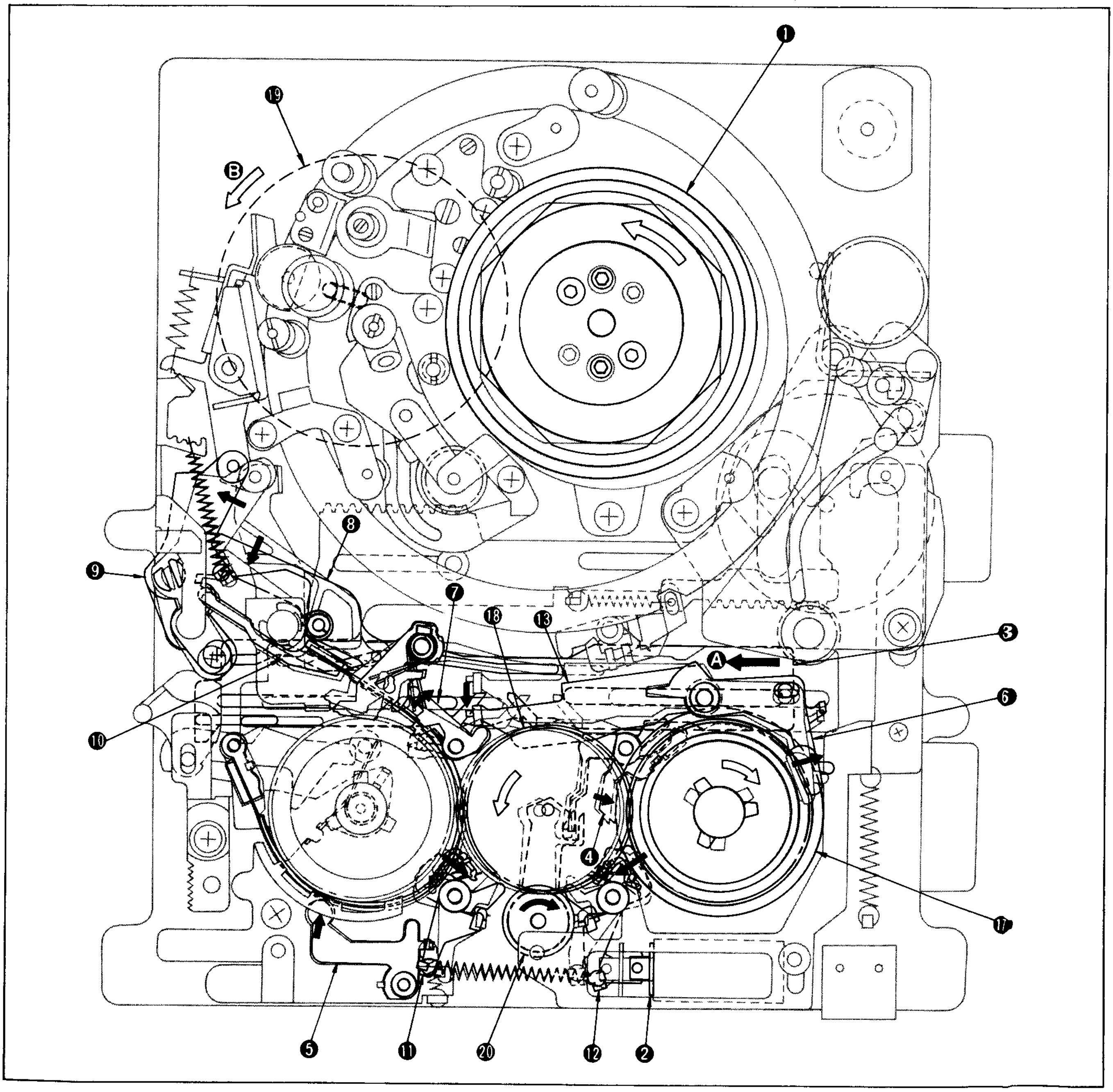


Fig. 9-11 a.

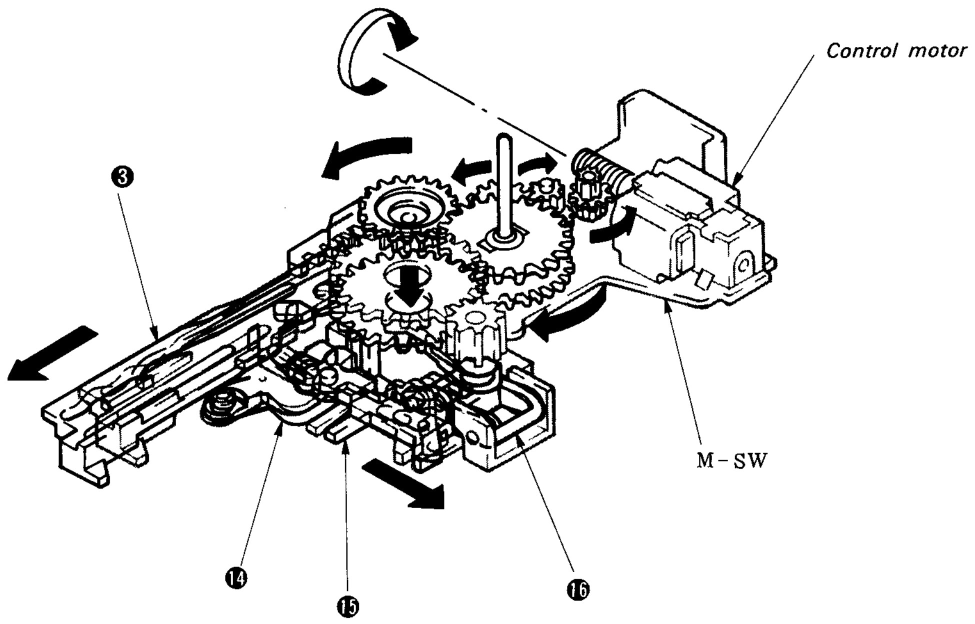


Fig. 9-11b.

9-2-6. STOP to REW

When REW button is depressed, the drum motor ❶ is driven first of all, turning on brake solenoid ❷. The control motor is turned on to set M-SW to FF/REW mode, moving M slider ❸ in the direction of arrow Ⓐ into FF/REW position. At this time, the cam of M slider ❸ works to turn on the REW brake ❹ and S soft brake ❺, applying light torque to S and T reel mounts. At the same time, the T soft brake ❻ and S hard brake ❼ are turned off. Furthermore, tension regulator load arm ❽ drives tension regulator arm ❾ and tension regulator band ❿.

The release of S main brake ⓫ and T main brake ⓬ is also transmitted from B release arm ⓭ to B release slider. At this time, brakes solenoid ❷ is held on.

Furthermore, the vertical switching arm A ⓮ drives the vertical switching slider ⓯, so that the drive gear B ⓲ is moved to the lower side in engagement with the mesh under the S reel mount ⓱ by the vertical switching arm B ⓰ of the general drive assembly.

Under this condition, the capstan motor ⓳ is started, and turns reversely in the direction of arrow Ⓑ. At the same time, the turning effort is transmitted by the timing belt to drive gear A ⓴ of the general drive assembly, so that the turning effort of the drive gear B ⓲ in mesh therewith acts on the lower gear of the S reel mount ⓱ to turn the S reel mount ⓱ by the turning effort of the capstan motor ⓳.

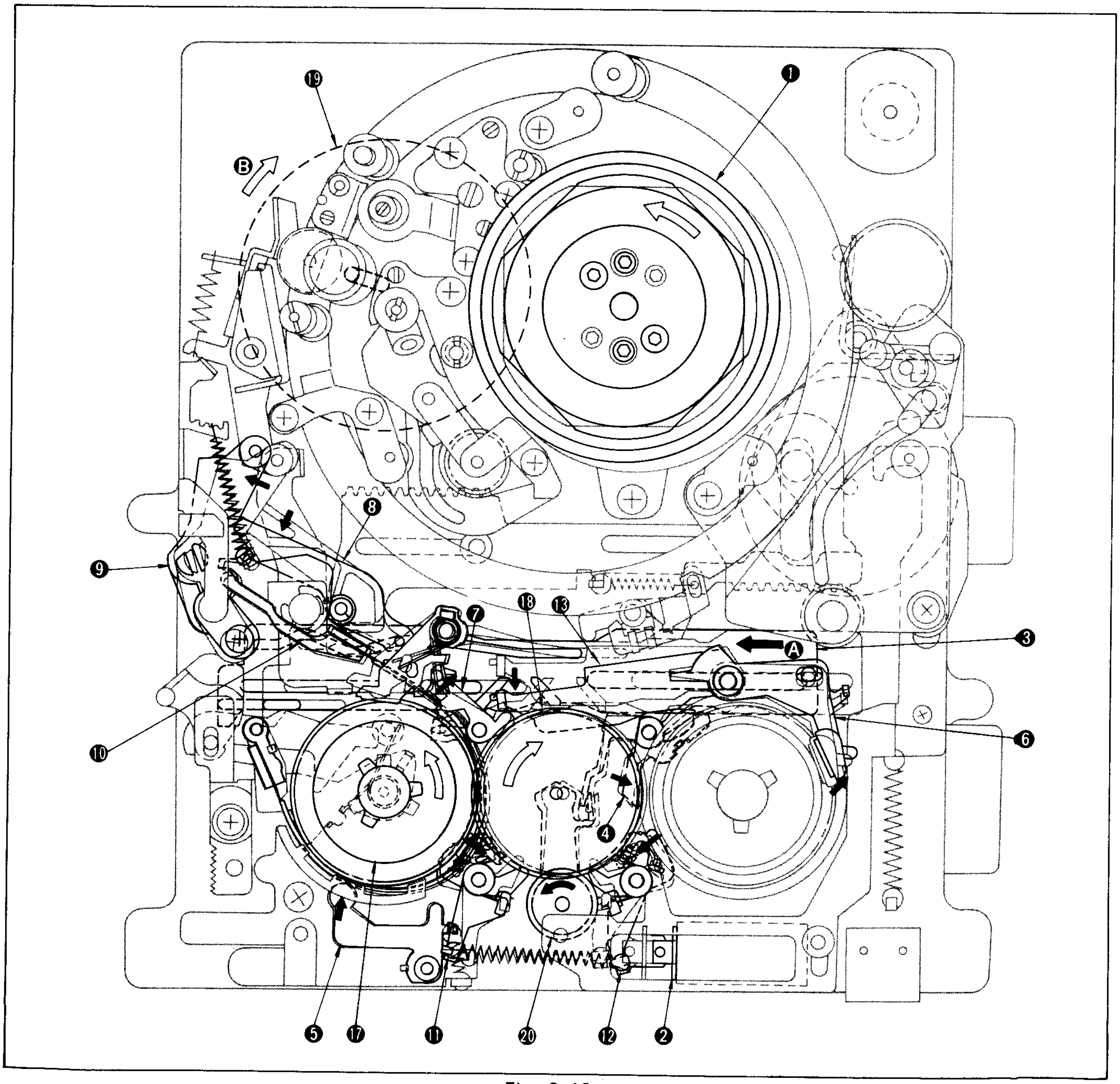


Fig. 9-12a.

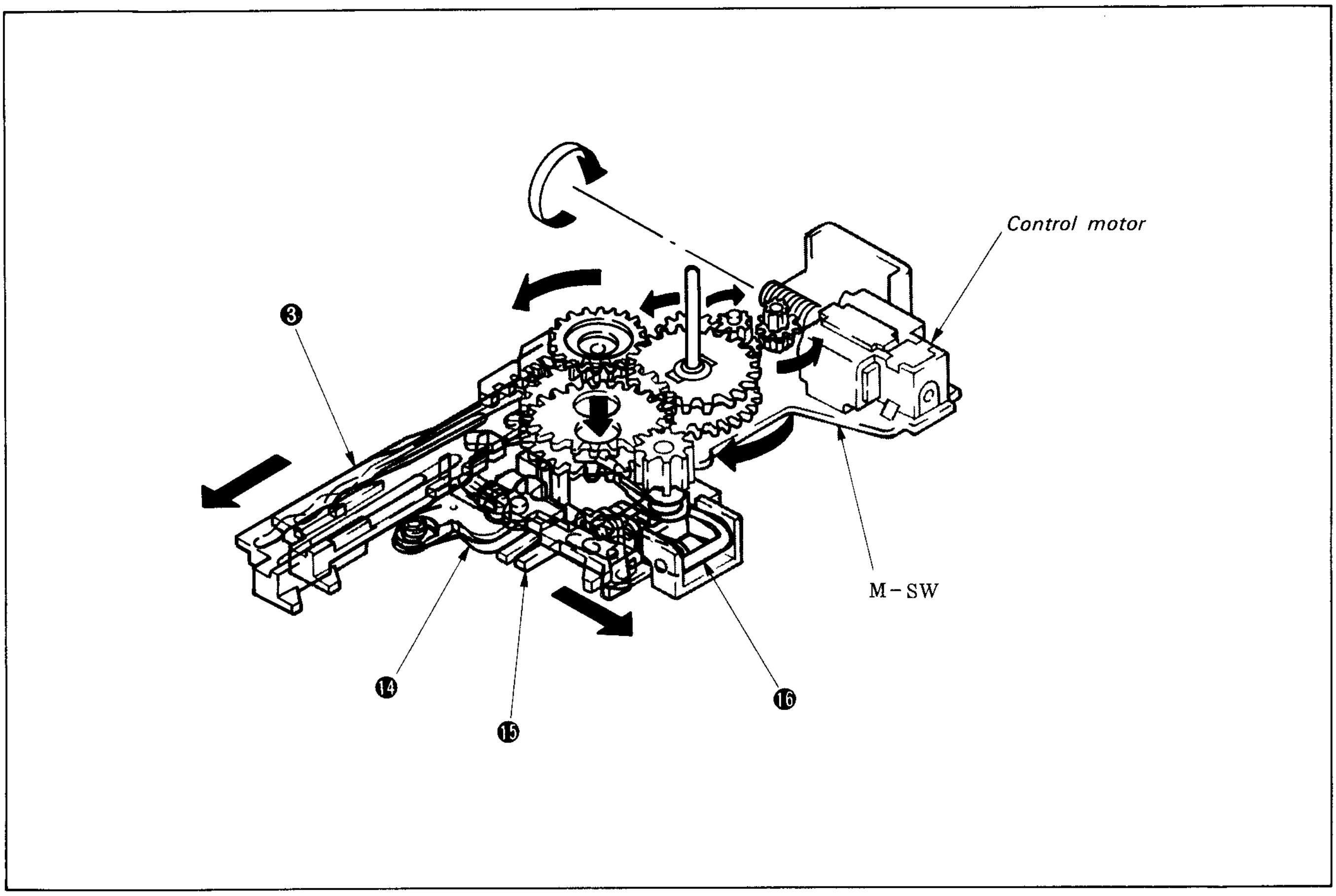


Fig. 9-12b.

9-2-7. PB to CUE

As long as the FF button is kept depressed in the PB mode, CUE mode is maintained.

First, when FF button is depressed, the capstan motor 1 rotates at a speed nine times higher than in PB mode. At the same time, the pinch roller 3 pressed against the capstan shaft 2 is driven in similar manner.

At the same time, the turning effort is transmitted by the timing belt to the drive gear A 4 of the general drive assembly, so that the rotation of the drive gear B 5 in mesh therewith drives the T reel mount 6 at a speed nine times higher, and taking up the tape.

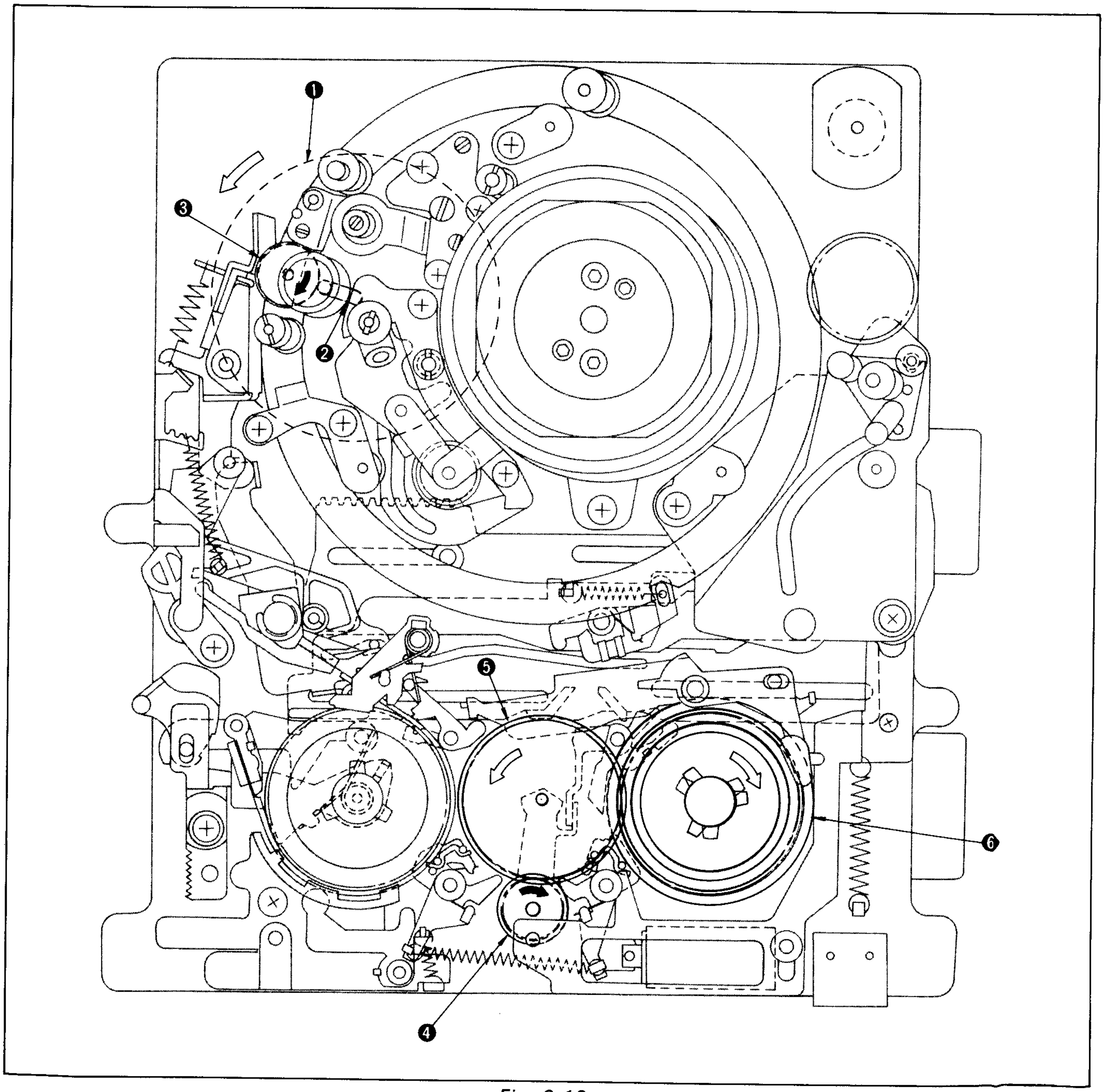


Fig. 9-13.

9-2-8. PB to REVIEW

As long as the REW button is kept depressed in the PB mode, REVIEW mode is maintained.
First, when REW button is depressed, the capstan motor ❶ stops, and so does the pinch roller ❷ pressed against the capstan shaft. At the same time, the turning effort is transmitted by the timing belt to drive gear A ❸ of the general drive assembly, so that the drive gear B ❹ in mesh therewith stops, and thereby stopping T reel ❺. Then, the control motor is turned on, setting M-SW into RVS mode, and moves the M slider ❻ in the direction of arrow Ⓐ into RVS position.
In the process, the cam of the M slider ❻ works to turn on the T soft brake ❼, REV brake ❽ and REW brake ❾, applying brake to the T reel mount ❺. At the same time, the mode arm ❿ moves to move the band arm ⓫, moving the tension regulator band ⓬. Also, tension regulator load arm ⓭ tension regulator is moved to fix the tension regulator arm. The RVS arm ⓮ is also moved in the direction of arrow by the function of the cam of M slider ❻, causing the drive gear B ❹ to engage the upper gear of the S reel mount ⓯. Also, both the S main brake ⓰ and T main brake ⓱ are slightly moved, but remain off.
Under this condition, the capstan motor ❶ turns at a rate seven times higher in the direction of arrow, rotating with the pressed pinch roller ❷. The turning effort is then transmitted by the timing belt to drive gear A ❸ of the general drive assembly, so that the drive gear B ❹ in mesh therewith is reversed in the direction of arrow Ⓑ, and the S reel ⓯ in the direction of arrow Ⓒ to rewind the tape.

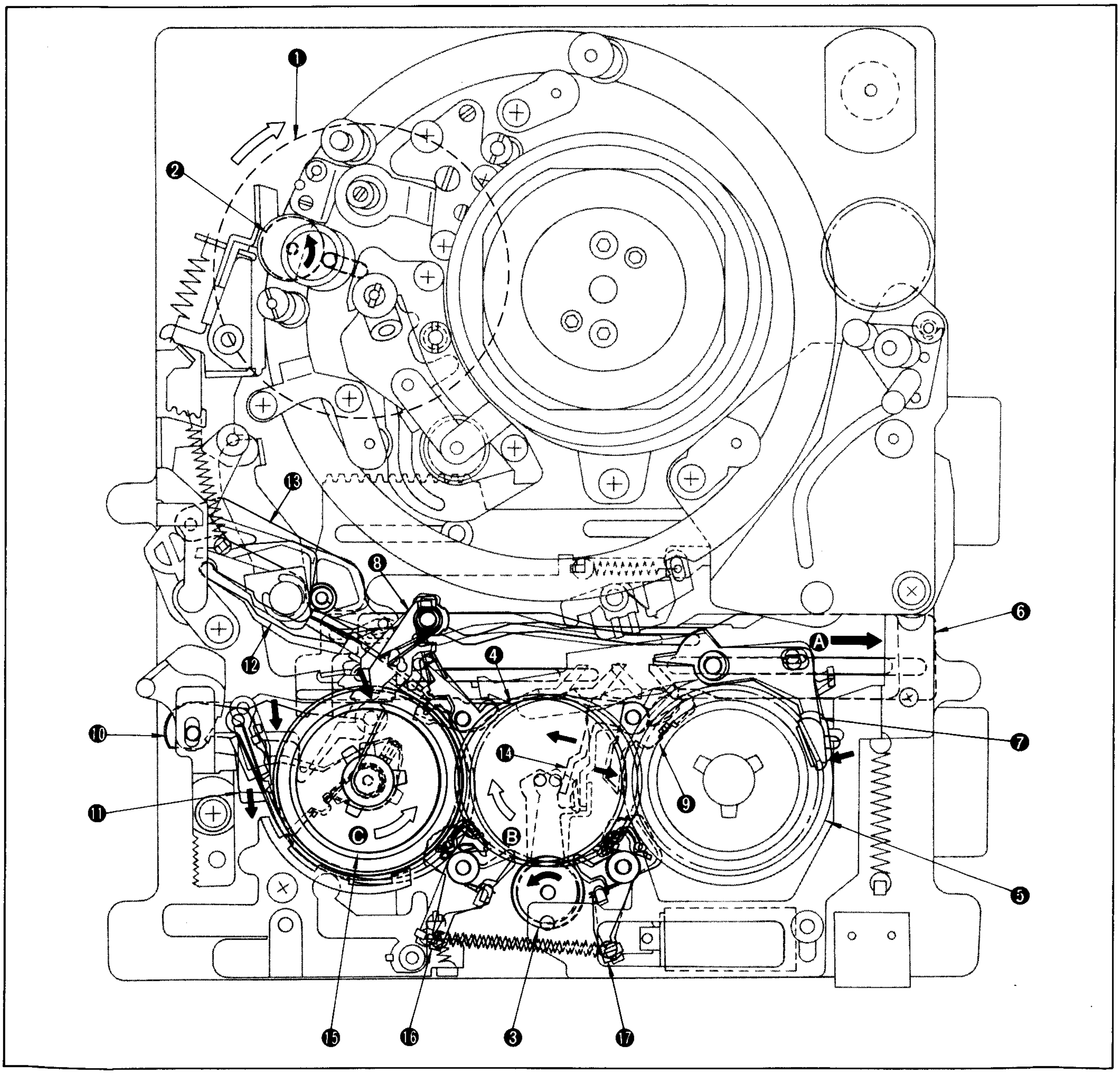


Fig. 9-14.

9-2-9. PB to PB PAUSE

When PAUSE button is depressed in the PB mode, the capstan motor ❶ stops and so does the pinch roller ❷ pressed against the capstan kshaft.

At the same time, by the timing belt, the turning effort is imparted to drive gear A ❸ of the general drive assembly, so that the drive gear B ❹ in mesh therewith stops, and at the same time, the T reel mount ❺ stops, entering the PB PAUSE Mode in that state.

Furthermore, by depressing the PAUSE button, the PB PAUSE mode is released, and the PB mode is entered.

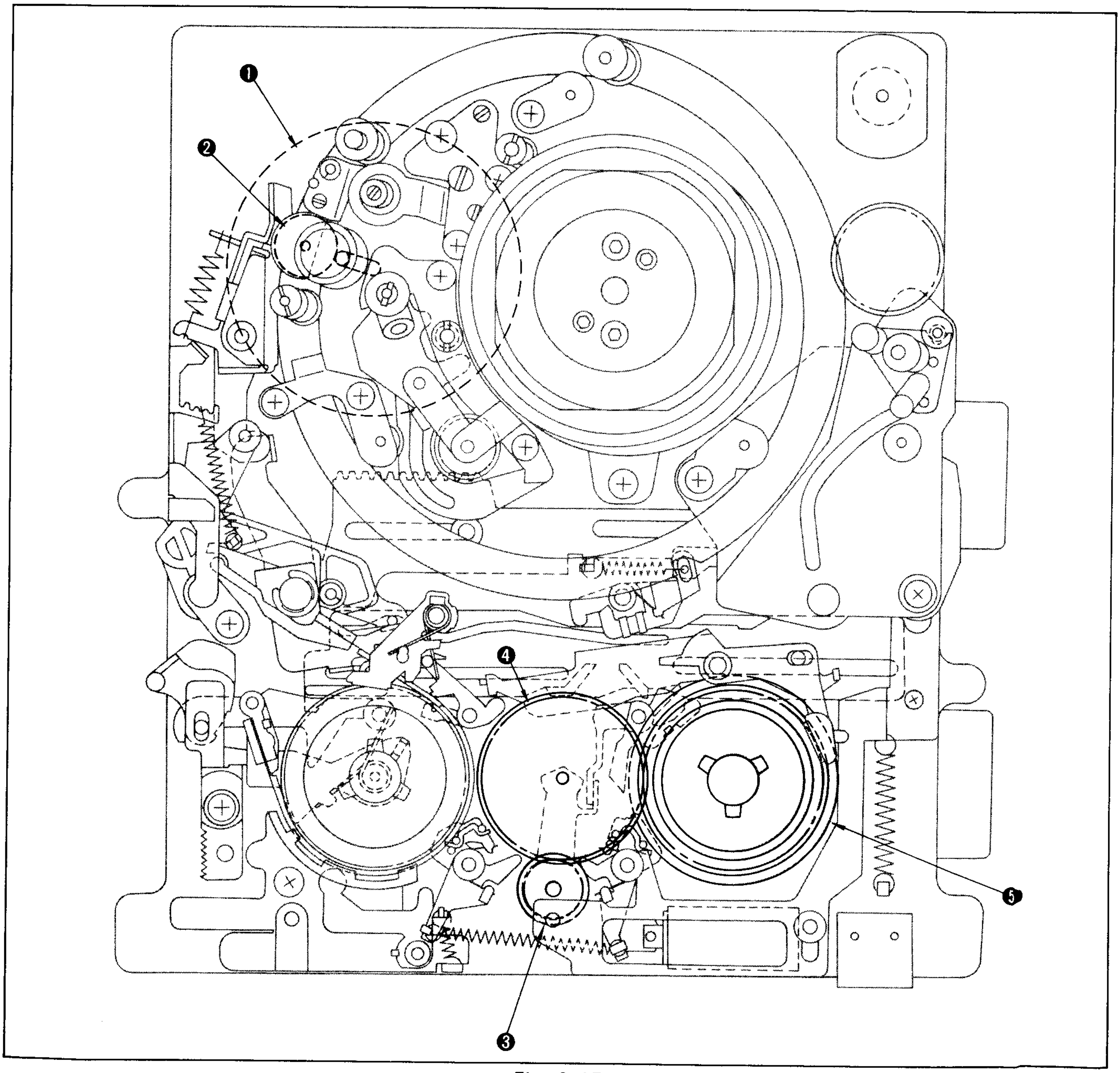


Fig. 9-15.

9-2-10. REC to REC PAUSE (INSERT to INSERT PAUSE PB PAUSE to INSERT PAUSE)

When PAUSE button is depressed in the REC Mode, the capstan motor ❶ stops first, and then the pinch roller ❷ pressed against the capstan shaft stops.
At the same time, brake is applied by the timing gear to the drive gear A ❸ of the general drive assembly, to stop the drive gear B ❹ in mesh therewith and also the T reel mount ❺.
Then, through M-SW driven by control motor, M slider ❻ moves in the direction of arrow Ⓐ into RVS position. In the process, the cam of M slider ❻ works to turn on the T soft brake ❼ and REW brake ❽ to apply braking force to the T reel mount ❺. At the same time, the REV brake ❾ works to brake the S reel mount ⓱.
Also, by mode arm ❿, the band arm ⓫ is moved to actuaten the tension regulator band ⓬.
Both S main brake ⓭ and T main brake ⓮ move slightly, but remain off. The tension regulator load arm ⓯ fixes the tension regulator arm. Furthermore, the cam of M slider ❻ works to drive the RVS arm ⓰ in the direction of arrow, causing the drive gear B ❹ to engage the upper gear of the S reel mount ⓱.
Under this condition, the capstan motor ❶ is driven reversely in the direction of arrow Ⓑ, driving the pinch roller ❷ pressed against the capstan motor in the same direction. Also, through the timing belt, the turning effort is imparted to the

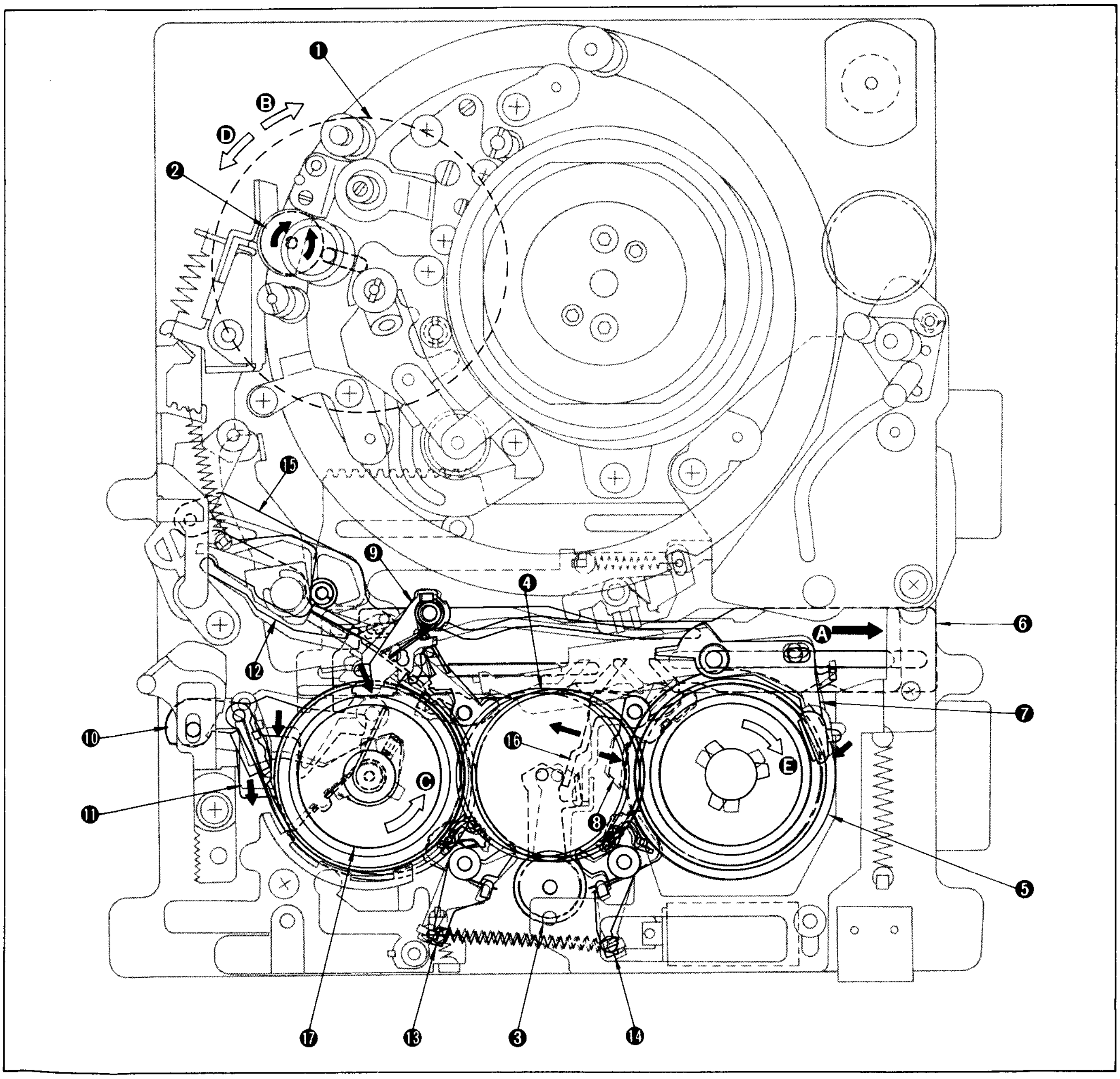
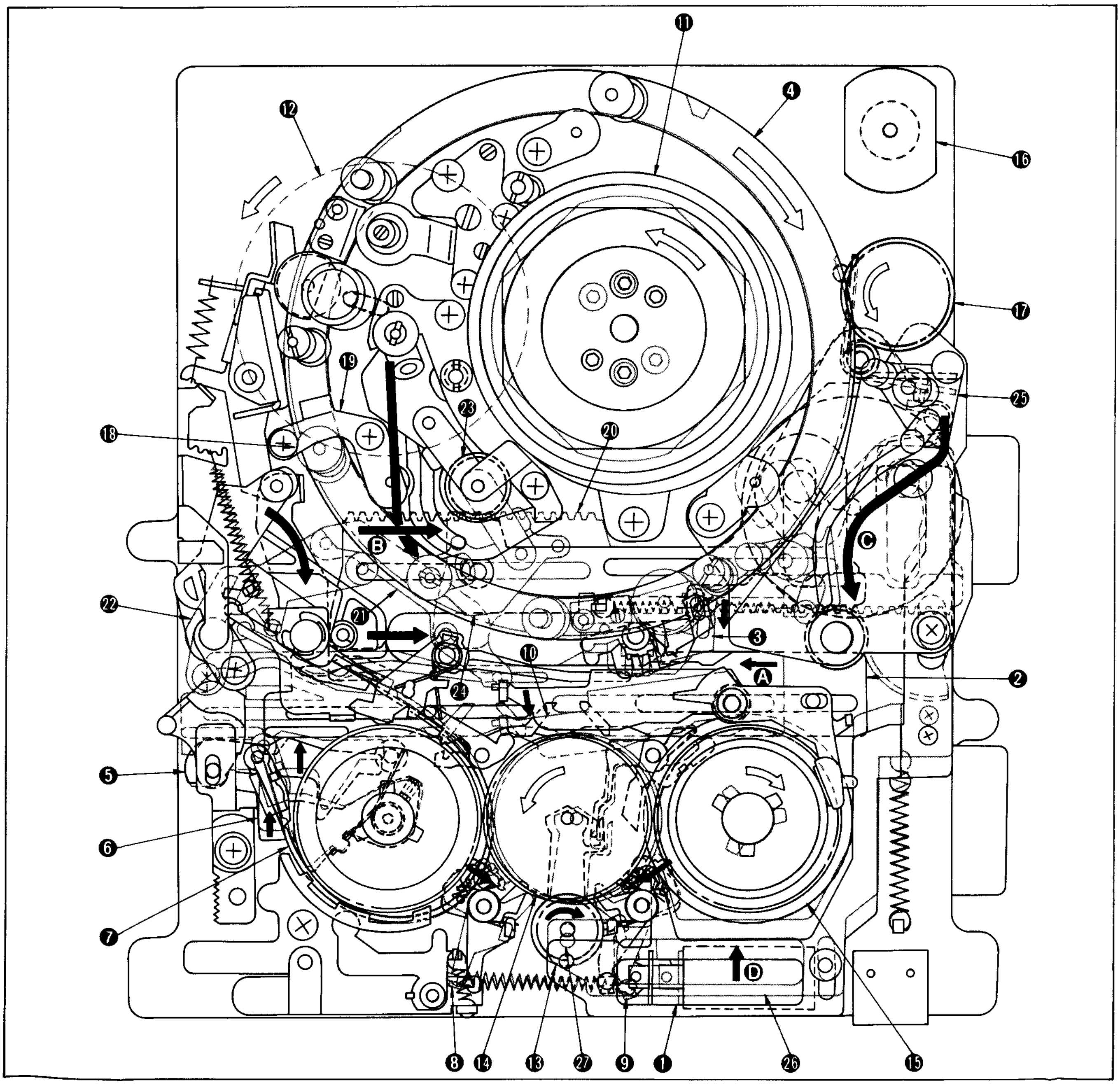


Fig. 9-16.

drive gear A ❸ of the general drive assembly, so that the drive gear B ❹ in engagement with it is rotated reversely to turn the S reel mount ⓱ in the direction of arrow Ⓒ, and thus returning the tape slightly.
After that, the capstan motor ❶ stops, stopping the S reel mount ⓱ at the same time.
Furthermore, through the M-SW driven by the control motor, the M slider ❻ returns to FWD position, turning off T soft brake ❼, REW brake ❽ and REV brake ❾. Then the mode arm ❿, band arm ⓫, tension regulator band ⓬, tension regulator load arm ⓯ and S main brake ⓭ and T main brake ⓮ are all returned to the original positions. At the same time, RVS arm ⓰ restores its original position, causing the drive gear B ❹ to engage the upper gear of T reel ❺.
Then, the capstan motor ❶ turns in the direction of arrow Ⓓ, and together with the pinch roller ❷ pressed against the capstan shaft, turns in the direction opposite to the arrow. By the timing belt, the turning effort is transmitted to the drive gear A ❸ of the general drive assembly, so that the drive gear B ❹ in mesh therewith is driven in the forward direction, rotating the T reel mount ❺ in the direction of arrow Ⓔ, which stops after feeding the tape a little.
This condition is held, and enters into the REC PAUSE mode.
This also applies to the INSERT PAUSE Mode. Furthermore, by depressing the PAUSE button, REC PAUSE mode is cancelled, and enters into the REC mode.

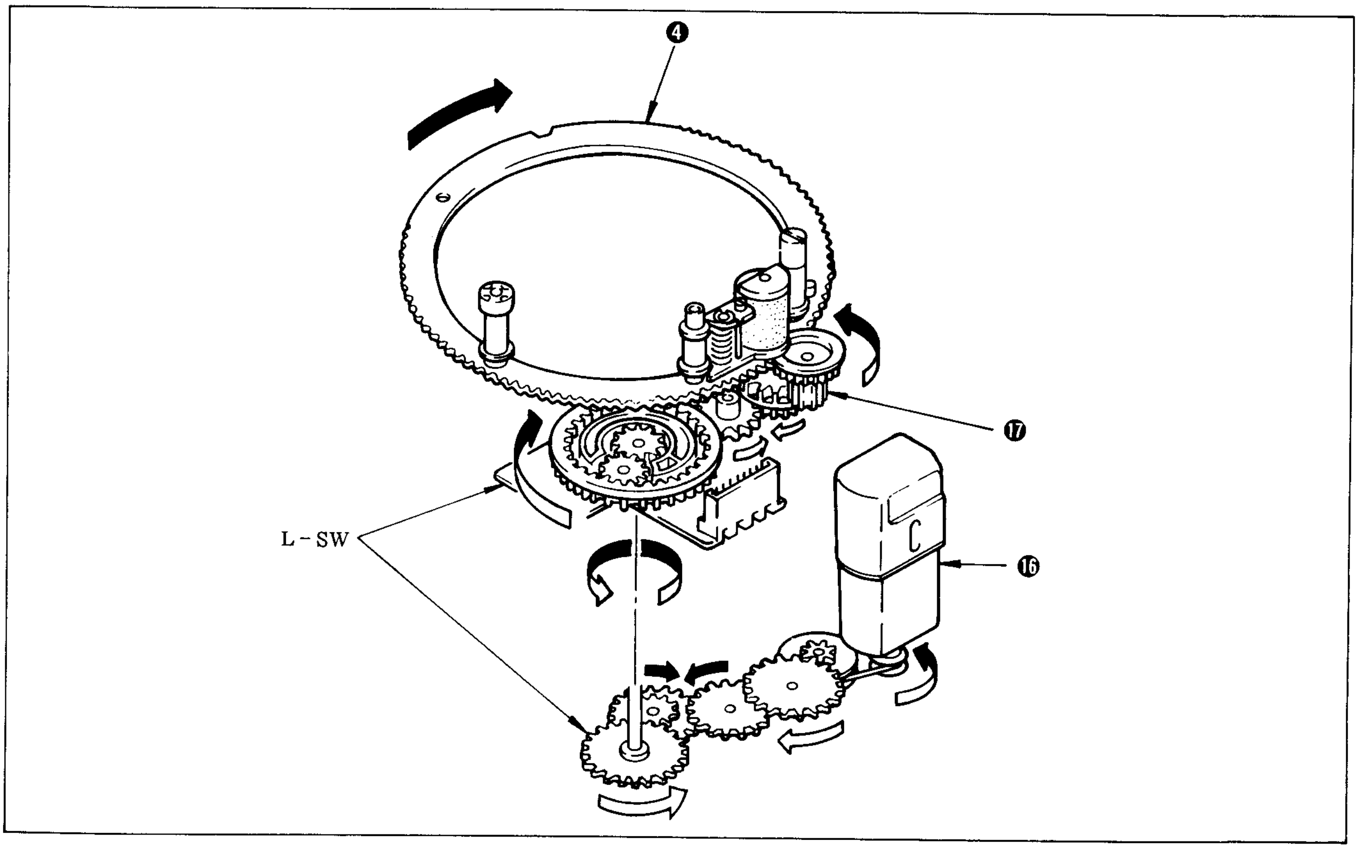
9-2-11. STOP to UNTHREADING to EJECT

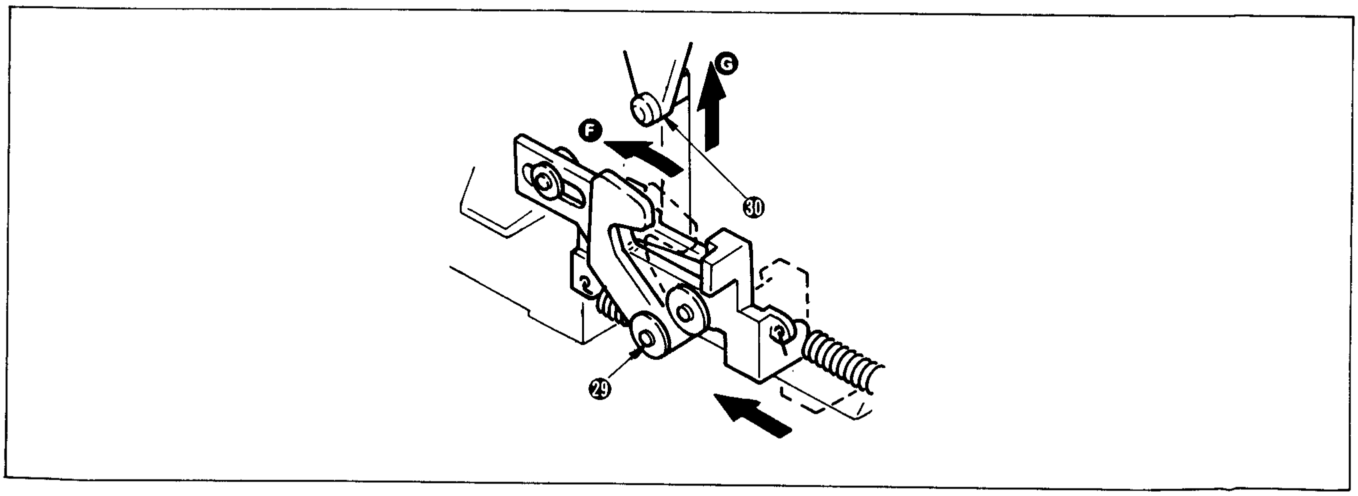
When EJECT button is depressed, the brake solenoid ❶ is energized. By means of M-SW driven by the control motor, M slider ❷ moves in the direction of arrow Ⓐ and into LOADING/ UNLOADING position. In the process, the cam of the M slider ❷ works to release the ring lock arm ❸, making the threading ring ❹ rotatable. Furthermore, the mode arm ❺ drives the band arm ❻ and tension regulator band ❼.
At the same time, the S main brake ❽ and T main brake ❾ are turned off, which are transmitted to B release arm ❿ and B release slider to turn them off.
Under this condition, the drum motor ⓫ and capstan motor ⓬ are both turned on and are in the direction of arrow, while, at the same time, the turning effort of the capstan motor ⓬ is imparted through the timing belt to the drive gear A ⓭ of the general drive assembly so that the drive gear B ⓮ in mesh therewith is driven to act on the upper gear of the T reel mount ⓯, with the result that the turning effort of the capstan motor ⓬ is imparted to T reel mount ⓯ to rotate it in the direction of arrow.
Furthermore, the L motor ⓰ starts, and through respective gears, its turning effort is transmitted to No.10 gear ⓱ to start the sledding gear ❹ along the direction of arrow. At the same time, the T reel mount ⓯ turns in the direction of arrow, starting to take up the tape. And when the lower part of No.8 guide ⓲ on the threading ring comes into contact with the ring stopper ⓳, the threading ring ❹ stops. Then, when L slider ⓴ moves in the direction of arrow Ⓑ, tension regulator load arm ㉑ drives the tension regulator arm ㉒, while the No.2 drive gear ㉓ urges the No.2 guide at the



entrance guide ㉔ and slant guide block ㉕ in the direction of arrow Ⓒ.
After the guides have returned to position, the lock slider ㉖ moves in the direction of Ⓓ, so that pin ㉗ energizes the reel lock in the cassette, locking both T and S reels. The L motor ⑯ thus ceases to be driven, to complete the UNTHREADING process. Finally, the M slider ❷ driven by the control motor is moved in the direction of arrow Ⓔ, and when it comes to the EJECT position, the EJECT turn plate ㉘ is urged in the direction of arrow Ⓕ. The lock ㉙ of cassette compartment is thus released along the direction of arrow Ⓖ, and the lock roller ㉚ comes off in the direction of Ⓗ, and turning up the cassette.

At the same time, during cassette position up, the M slider returns to LOADING/UNLOADING position to end EJECT.





9-3. MECHANICAL OPERATION OF THE INDIVIDUAL SECTIONS

1) Gear train

The driving force of the loading motor is imparted to L-SW assembly by being reduced in speed through No.1 gear, No.2 gear, No.3 gear and No.4 gear.

2) Drive source of reel mounts

The driving force of the reel mounts is derived from a capstan motor, and by utilizing the forward and reverse drive of the capstan motor, that drive gear (B) is caused to engage both S and T reel mounts. The drive arm of the general drive assembly is movable freely in the four directions, and by taking advantage of the forward and reverse turns imparted thereto through the timing belt form the capstan motor, it drives the drive gear (B).

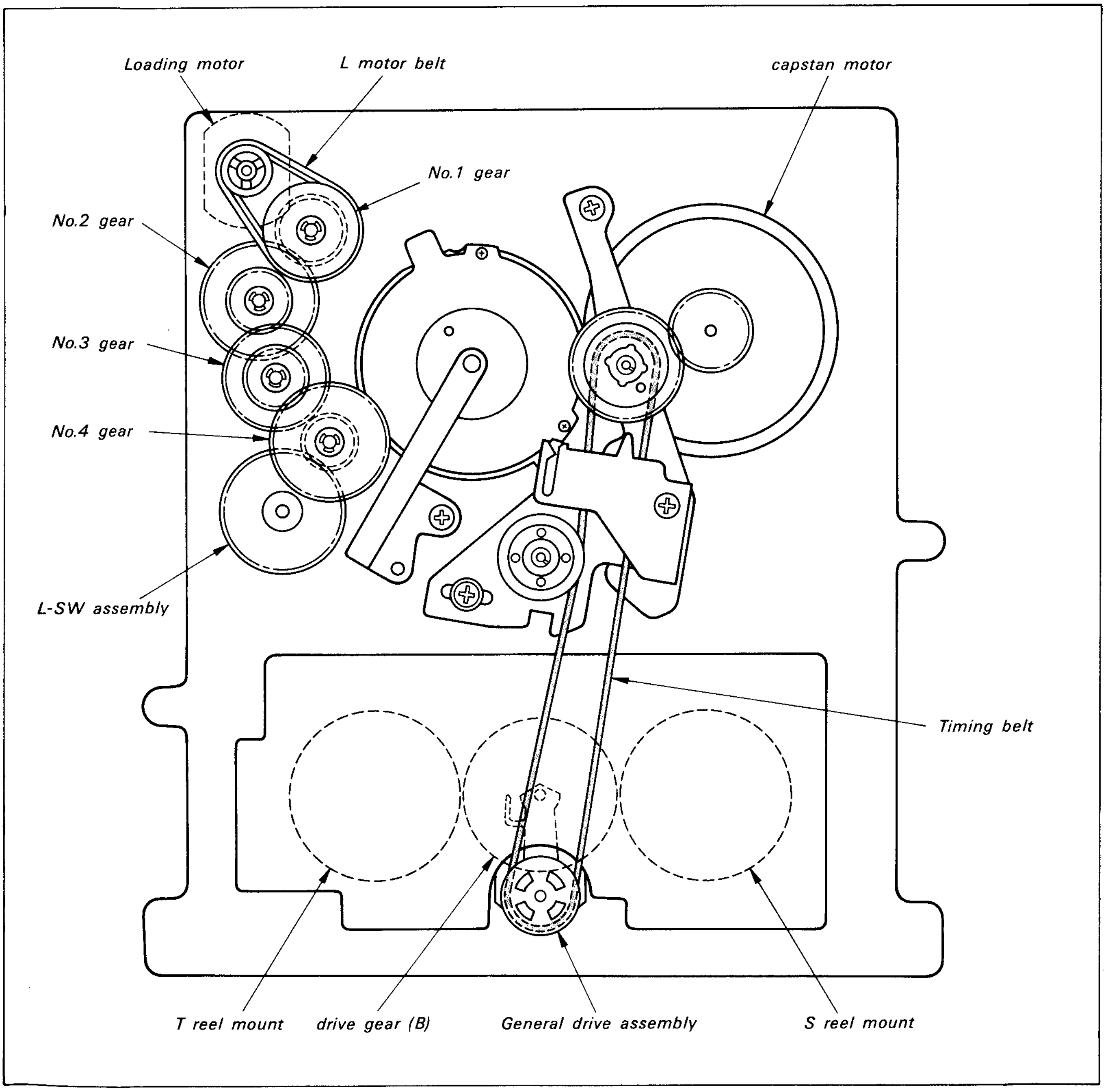


Fig. 9-18.

3) L-SW assembly

The L-SW assembly is a planetary gear reduction unit having the function of position switch for detecting the positions of LOADING, TOP and LOADING END.

The drive force of L motor is transmitted to a sun gear at the center, and through a drive changer mentioned later, is transmitted to a planetary gear base or ring gear.

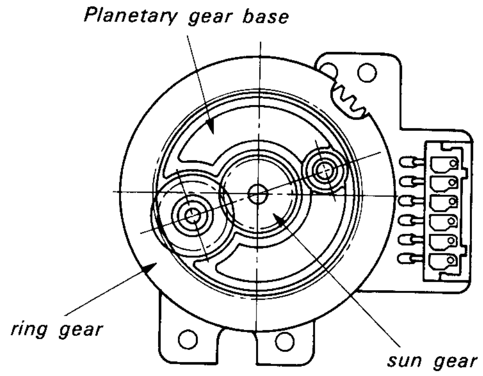


Fig. 9-19.

4) Drive changer

The drive changer is made up of an arm of a shape shown in Fig. 9-20, and is pressed along the direction of arrow Ⓐ by a torsion spring around the shaft thereof. In the case of arm loading, the roll falls in a slot formed in the ring gear, and therefore the planetary gear base turns in the direction of arrow.

At the end of arm loading, the planetary roll arranged on the planetary gear base pushes the drive changer along arrow Ⓑ and thereby cancelling the lock of the roll. Then, the ring gear rotates in the direction of arrow, and through No.8 gear, No.9 gear and No.10 gear, the loading ring is driven.

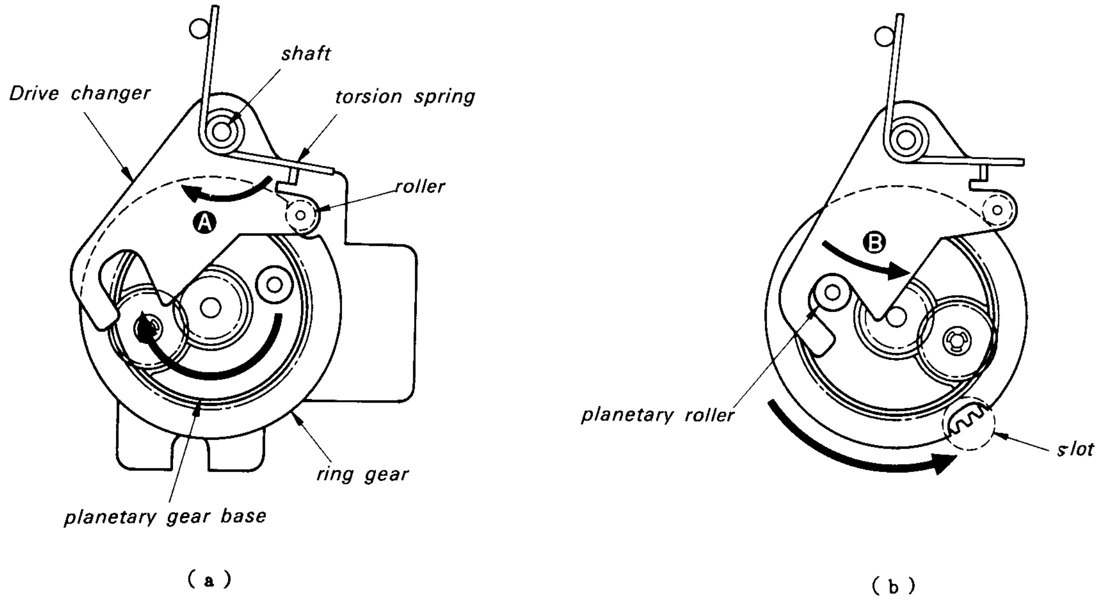


Fig. 9-20.

5) L slider

The driving force of the planetary roller on a planetary gear base is converted into lateral motion to move or press then tension regulator arm, No.2 guide assembly or slant guide.

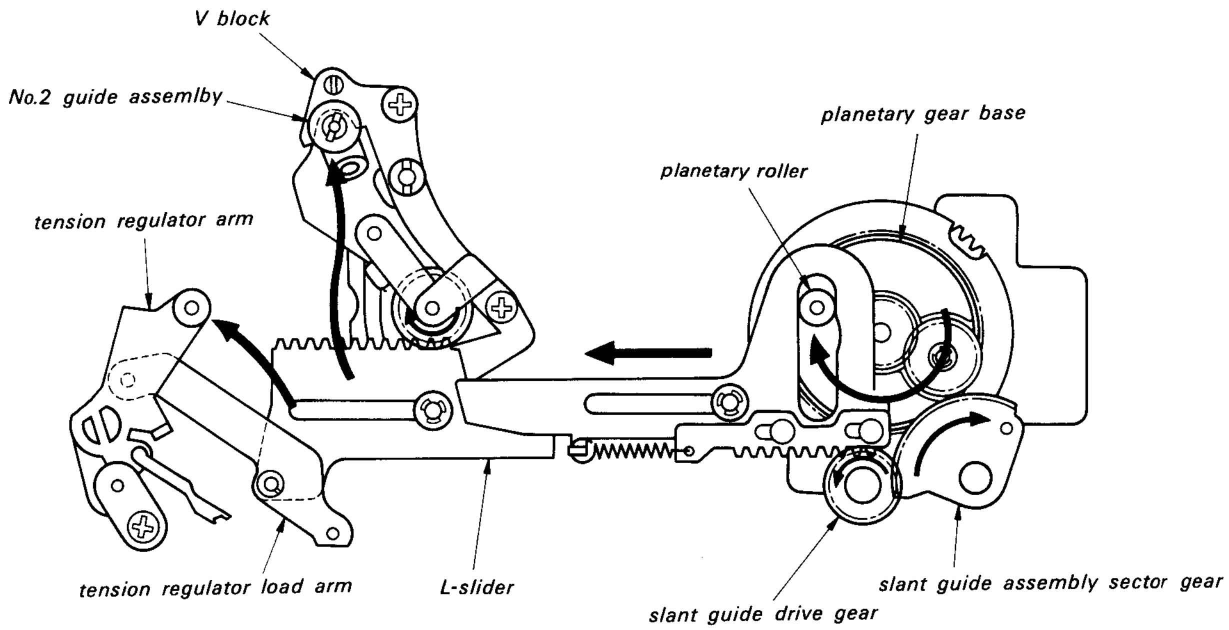


Fig. 9-21.

6) Entrance guide assembly (No.2 guide assembly)

When the arm rotates around the shaft in response to the driving force received from the rack gear of the L-slider, the arm is guided along a cam slot and pressed against the V-block to determine the position thereof. The overstroke after pressing is absorbed into a torsion spring built in the arm.

7) Slant guide assembly

The slant guide base is driven by arm moved by a sector gear on the body from the rack gear on the L-slider and slant guide drive gear.

The slant guide base is moved along the cam slot in a manner not to interfere with the cassette or drum, and being opressed against the forward end pin, is determined as in position.

The overstroke after pressing is absorbed into the tensile coil spring on the L-slider, while the overstroke at the time of unloading is absorbed into the torsion spring built in the body.

8) Lock slider

When the planetary roller rotates in the direction of arrow at the initial stage of arm loading, the tensile coil urges the lock slider in the direction of arrow, with the result that the release pin at the forward and thereof releases the reel lock in the cassette.

At the time of unloading, on the other hand, the lock slider is lifted in the direction of arrow by the planetary roller to lock the reel after all guides have ben returned.

Moreover, the stroke of the release pin is defined by the slot formed in the lock slider.

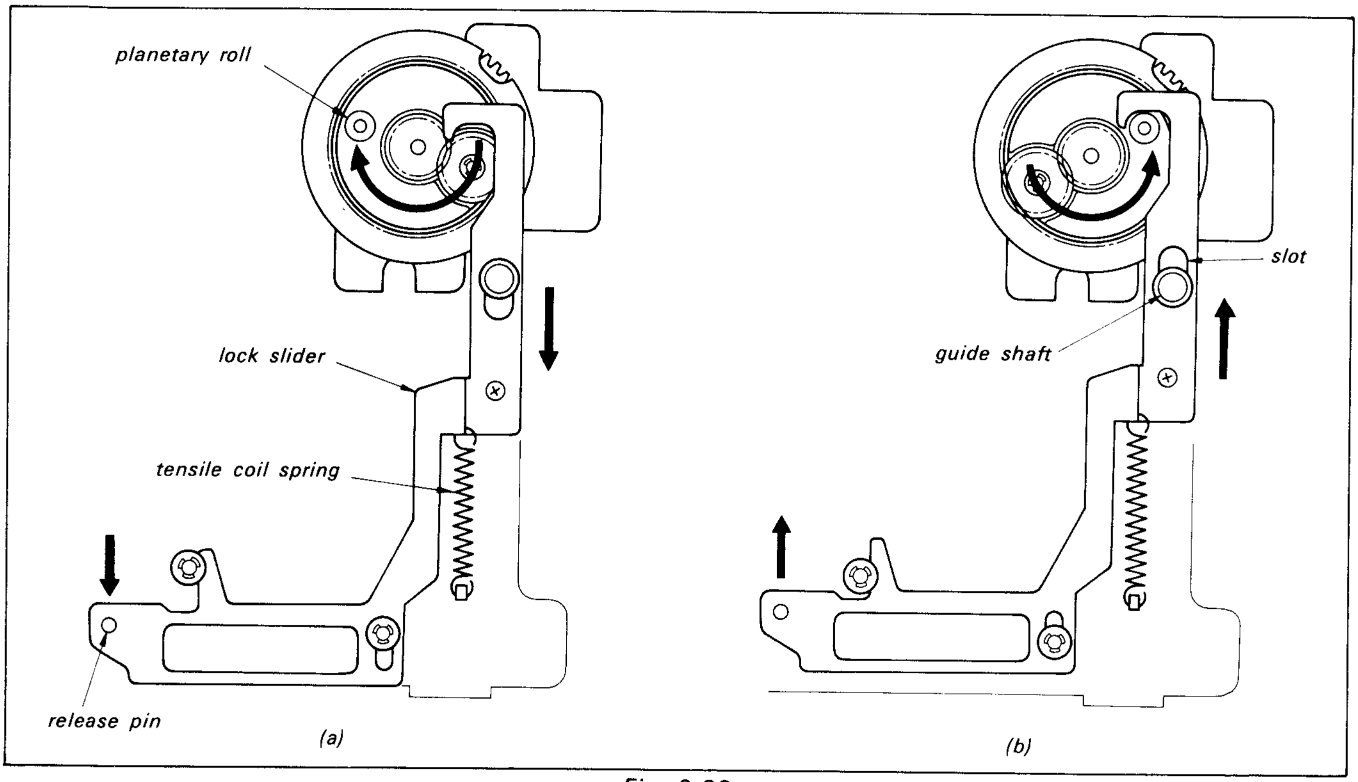


Fig. 9-22.

9) Vertical switching of drive gear (B)

As shown in Fig. 9-23, the upper gear of the S and T reel mounts corresponds to FWD/RVS system, and the lower gear thereof to FF/REW system. Normally, the drive gear (B) is situated at the upper side, and lowers only in FF/REW mode.

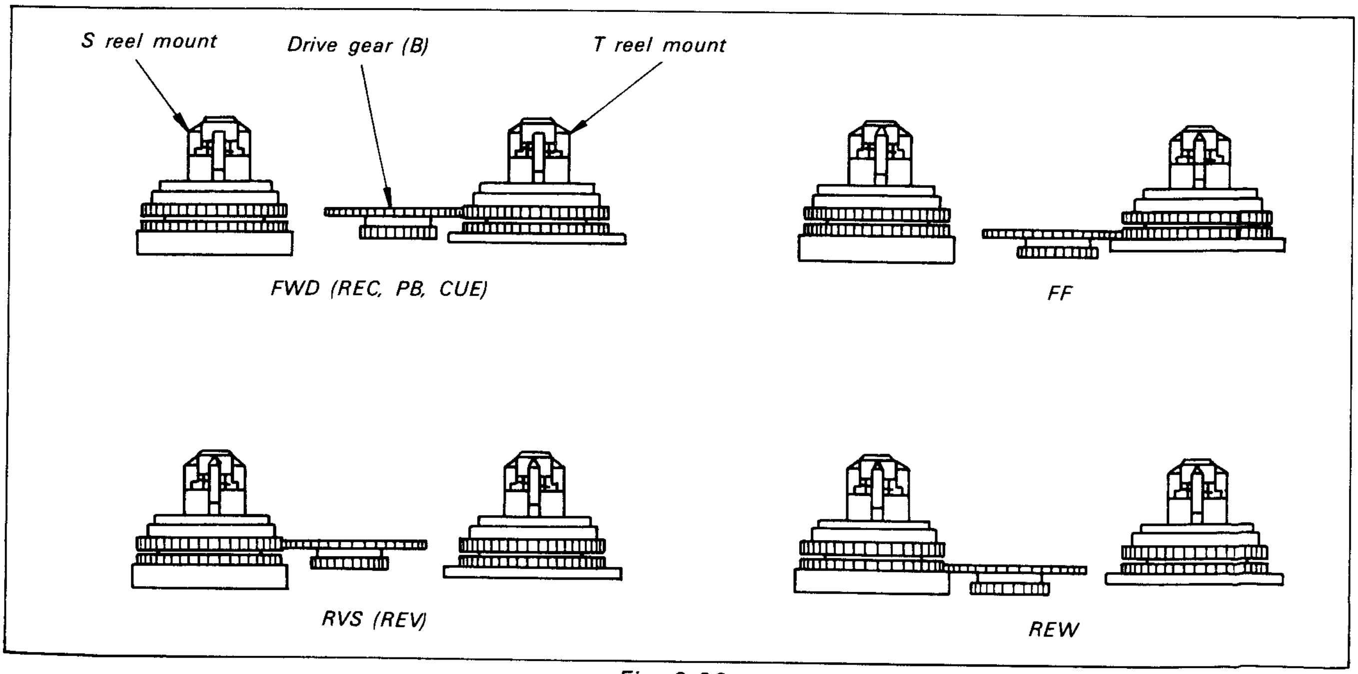


Fig. 9-23.

10) Drive source of mode switching system

The basic concept of the mode switching system is to detect six positions by a rotary switch on COC (circuit on chassis) using the control motor on the M-SW assembly as a motive power and thereby switching to the mode. The output of the control motor is transmitted through a reduction gear to M slider finally. By taking advantage of the motion of the M slider, the six positions including EJECT, LOADING/UNLOADING, FF/REW, STOP, FWD (PB, REC, CUE), RVS (REV) are switched to perform such operations as pressing of pinch roller, cencellation of tension regulator turning on/off of the soft brake, tension regulator band or ring lock.

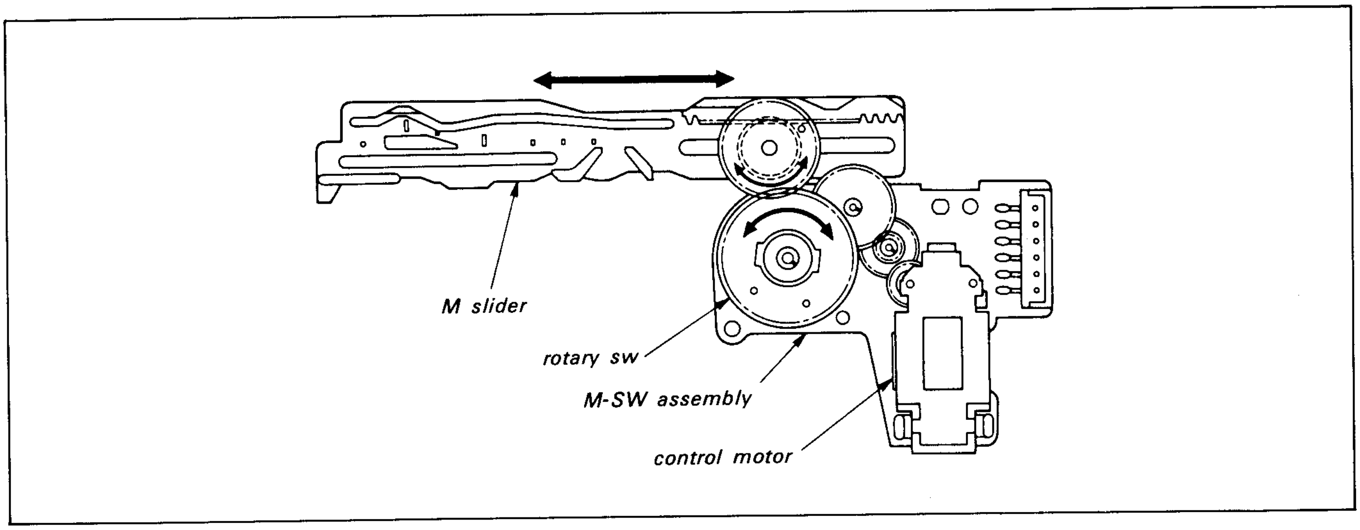


Fig. 9-24.

11) Function of brake solenoid

This brake solenoid is used to improve the sharp collison at the tape end or loosened tape which might occur upon depression of the STOP button mainly from FF/REW mode.

Specifically, by pushing the pin of the B release arm by a "/lerrer "-shaped cam of the M slider, the B release slider is pressed down to release the S and T main brakes.

In the process, the brake solenoid is energized to lock the B release slider. Although comparatively large current flows at the time of attraction, the holding is the only operation under absorption, thus holding the main brakes with small current, and thus saving power.

In FWD mode, however, both S and T main brakes are released by the "/letter "-shaped cam of the M slider, and thereby eliminating the use of solenoid.

Thus power is saved even more in the FWD mode.

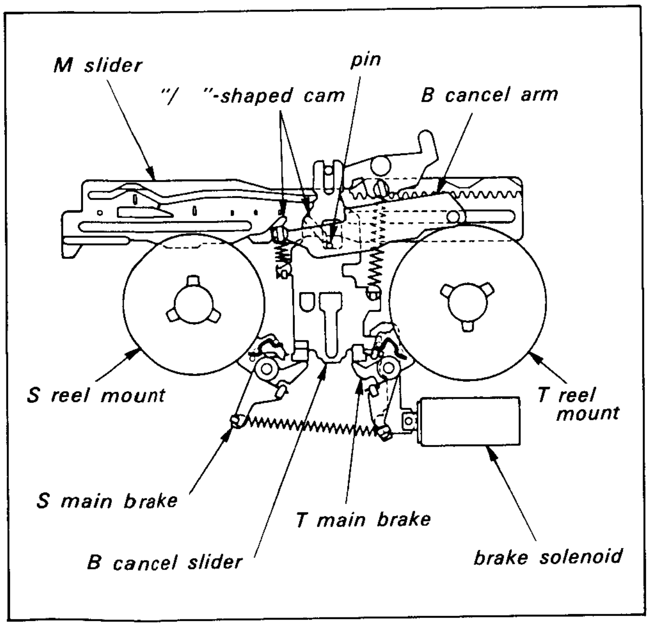


Fig. 9-25. FF/REW

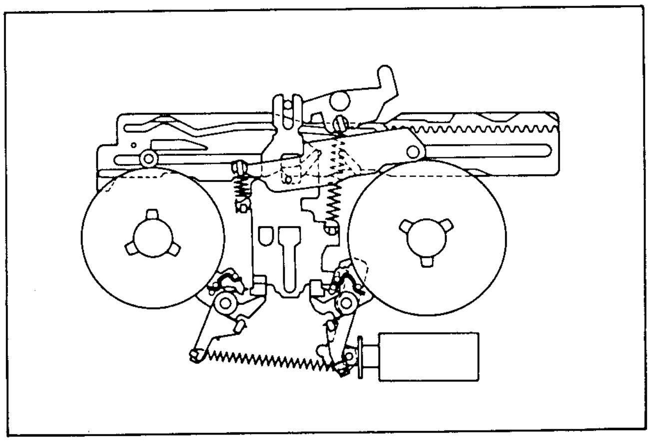


Fig. 9-26. FWD (REC, PB, CUE)

EV-S700ES/UB

9-972-416-11

Sony Corporation

English
85K0965-1
Printed in Japan

EV-S700ES/UB
RMT-405

SONY
SERVICE MANUAL

AEP Model
(EV-S700ES)
UK Model
(EV-S700UB)
January, 1986

SUPPLEMENT-1

Subject: Australian Model

- The Australian model EV-S700AS has been designed based on the EV-S700ES AEP model.
  The main difference between the two models is the tuner block.
  This Supplement-1 includes the main differences between the two models, including block diagram, schematic, mounting diagram and parts list.
  Refer to the Service Manual for EV-S700ES/UB for other information.

Subject: Video Block Circuit

- The video block circuit has been changed and the SK-9 boaed has been added partway through production.
  This Supplement-1 includes the schematics, mounting diagram and parts list for the changed video block.
  The video block included for the Australian model is for all sets.
- File this Supplement-1 with the Service Manual.

MICROFILM

Consumer VIDEO

TABLE OF CONTENTS

1. GENERAL

Supplement to the EV-S700ES/UB Operating Instructions on Service manual.

The EV-S700AS is almost the same as the EV-S700ES/UB. The differences relate mainly to the difference in TV broadcasting system.

TV channel coverage of the EV-S700AS

VHF: Australian channels 0 through 5 (Band indicator VL) and 5a through 11 (VH)

UHF: Australian channels 28 through 34 and 39 through 63 (U)

The recorder operations are the same as those of the EV-S700ES/UB, except for the following pages of the Operating Instructions on Service manual.

SPECIFICATIONS of the EV-S700AS

Only the following items should be changed.

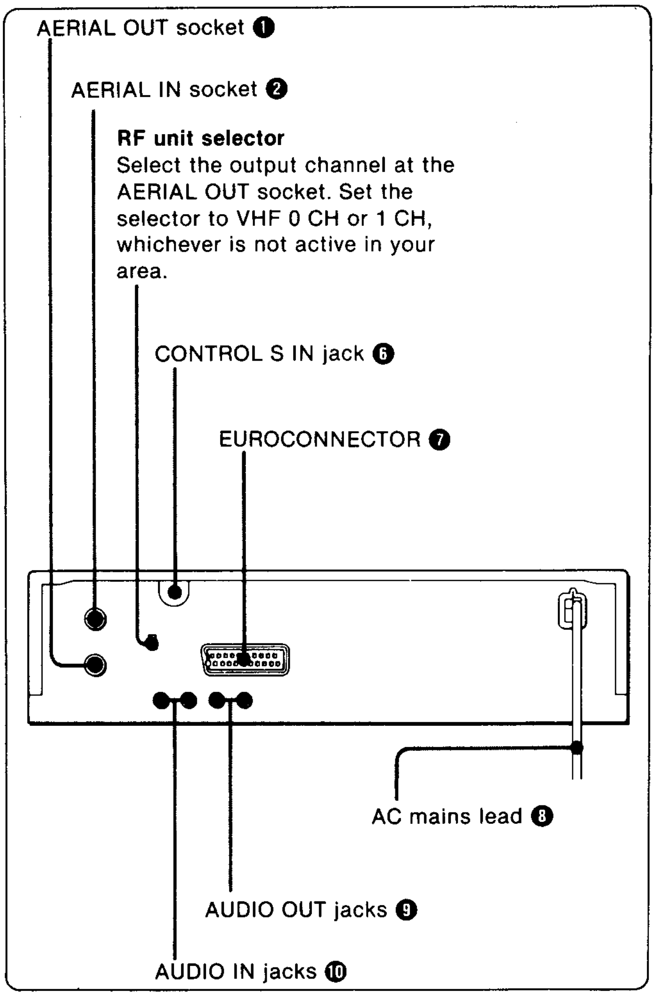
Video signal	CCIR standards, PAL color
Channel coverage	VHF Channels 0–5 and 5a–11 UHF Channels 28–34 and 39–63
RF output signal	VHF channel 0 or 1 selectable, 75 ohms, unbalanced
Power requirements	240 V ac, 50 Hz
Power consumption	44 W

Accessories supplied

Video cassette tape (1), Connecting cord RK-74H (1), Connecting cable VMC-2106S (1), 75-ohm coaxial cable for TV connection (1), Screwdriver (1), Remote Commander RMT-405 (1), Batteries IEC designation R6 (2)

Page 8

Rear of the EV-S700AS



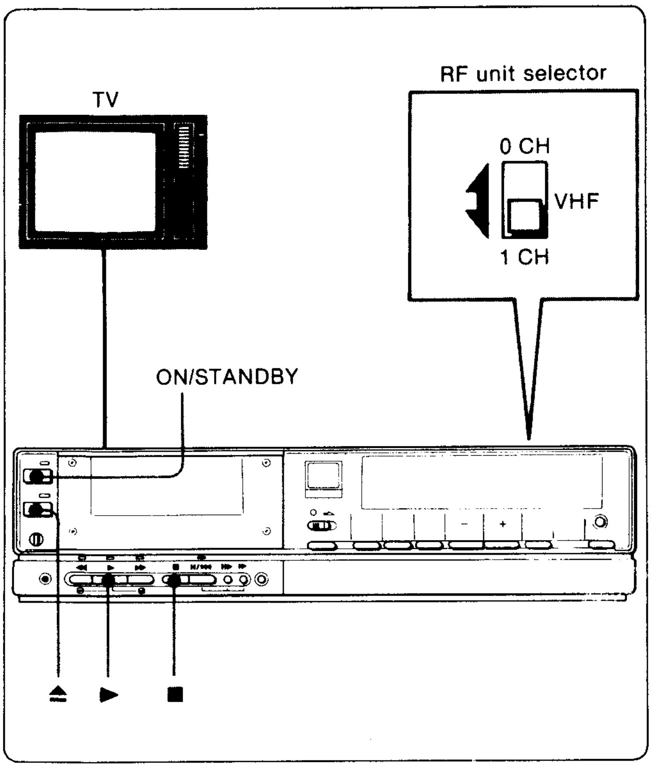
Note

The functions of parts other than the RF unit selector are the same as those of the EV-S700ES/UB. Refer to page 8 of the Operating Instructions on Service manual for parts with the same number circled.

Page 11

ADJUSTING THE TV

When your TV is connected to the recorder AERIAL OUT socket, adjust the TV to receive the signal from the recorder as follows. Ignore the entire description of "ADJUSTING THE TV" on page 11 of the Operating Instructions on Service manual.

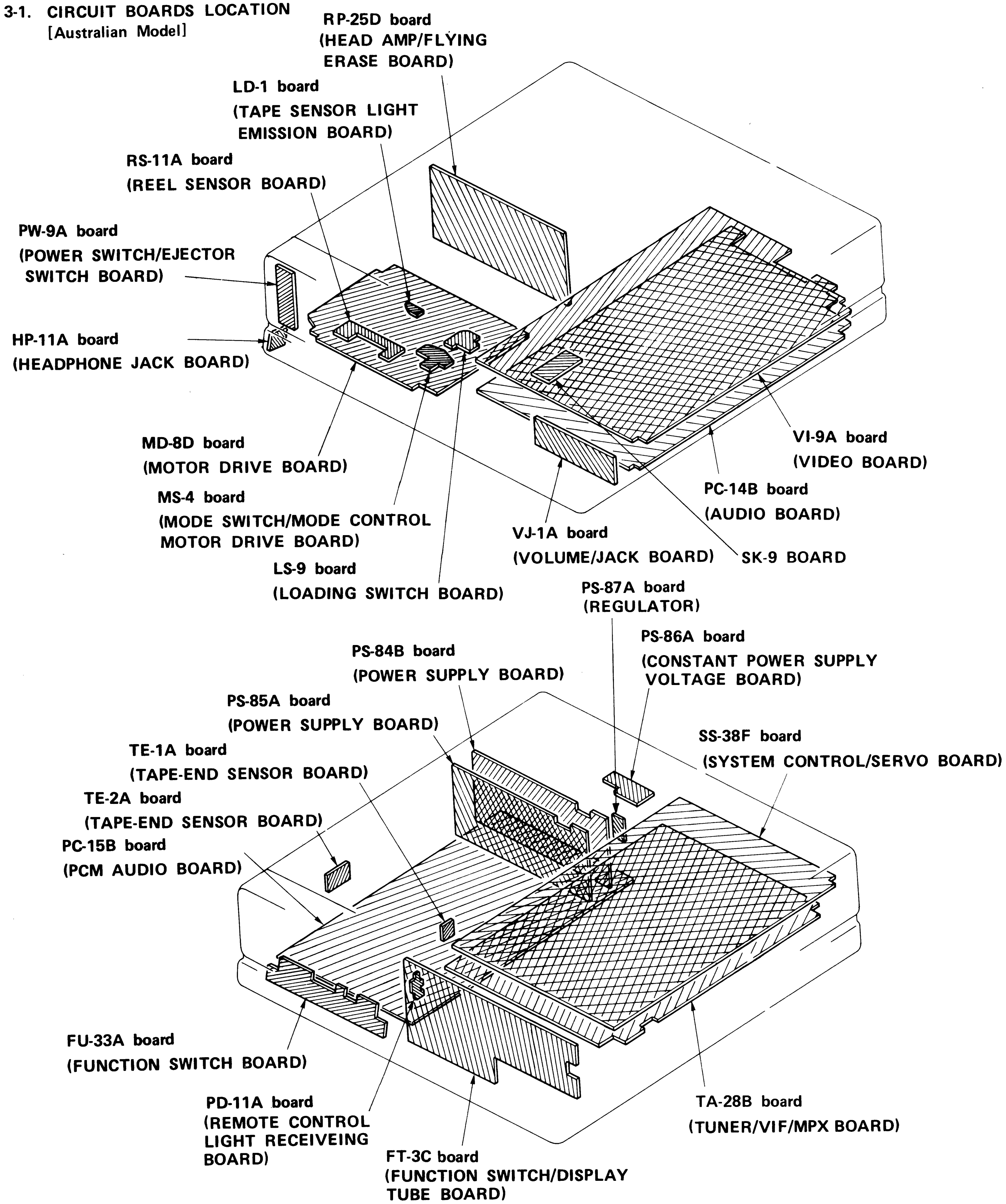


1 Set the RF unit selector located at the rear of the recorder to VHF 0 or 1 CH, whichever channel is not active in your area.
2 Press the ON/STANDBY button.
3 Press the ≜ button and insert a recorded video cassette with the side from which the tape is visible up and in the direction of the arrow on the cassette.
4 Press the ▶ button.
5 Turn on the TV.
6 Set the TV to either VHF channel 0 or 1 to agree with the setting of the RF unit selector. The tape programme will be displayed on the TV screen. If the display is not clear, fine-tune the channel on the TV.

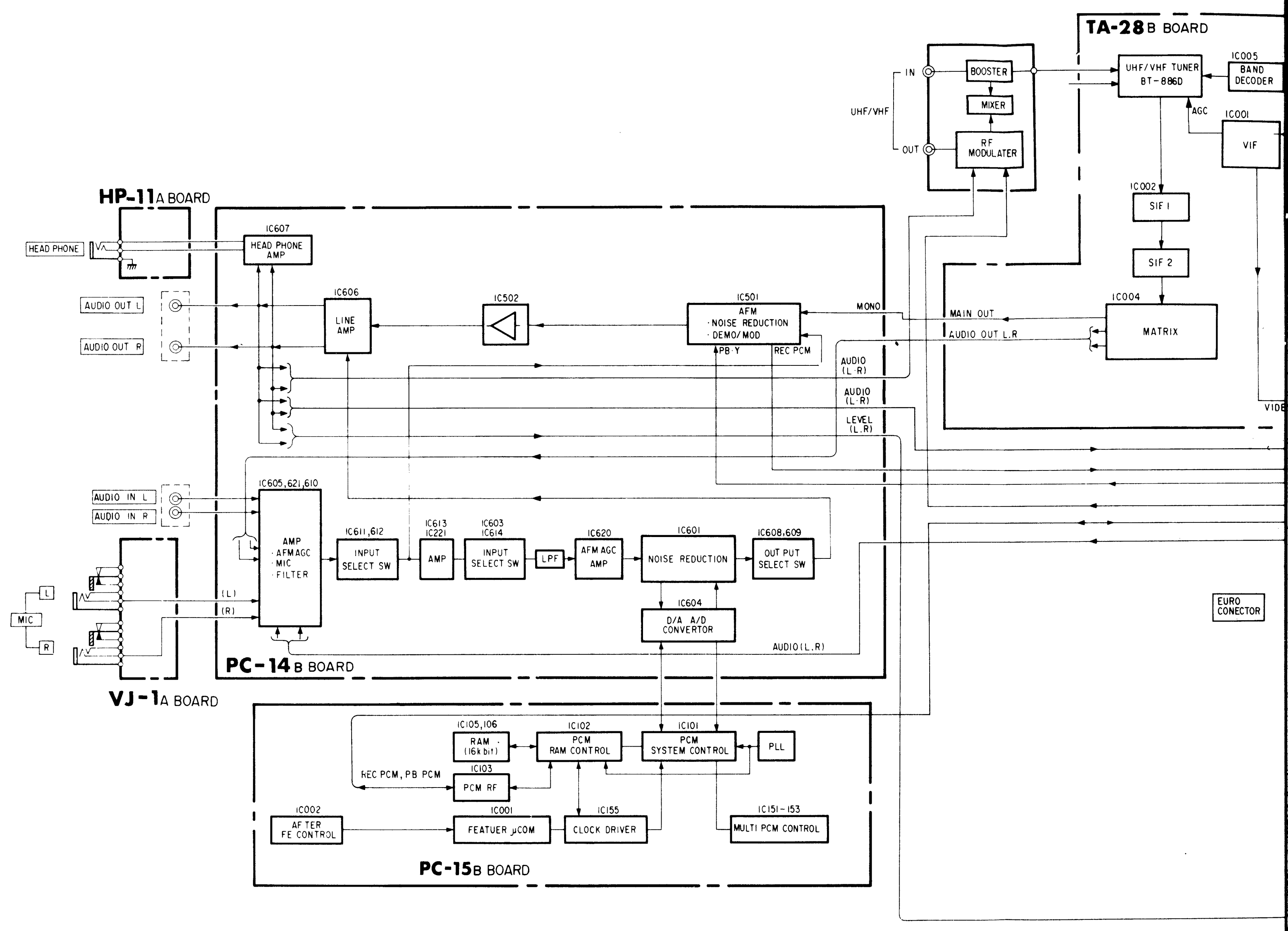
After adjustment, check that the display on the screen changes when you stop the tape by pressing the ■ button on the recorder. If the display does not change, repeat the preceding steps. (To eject the cassette, press the ≜ button.)

3. DIAGRAMS

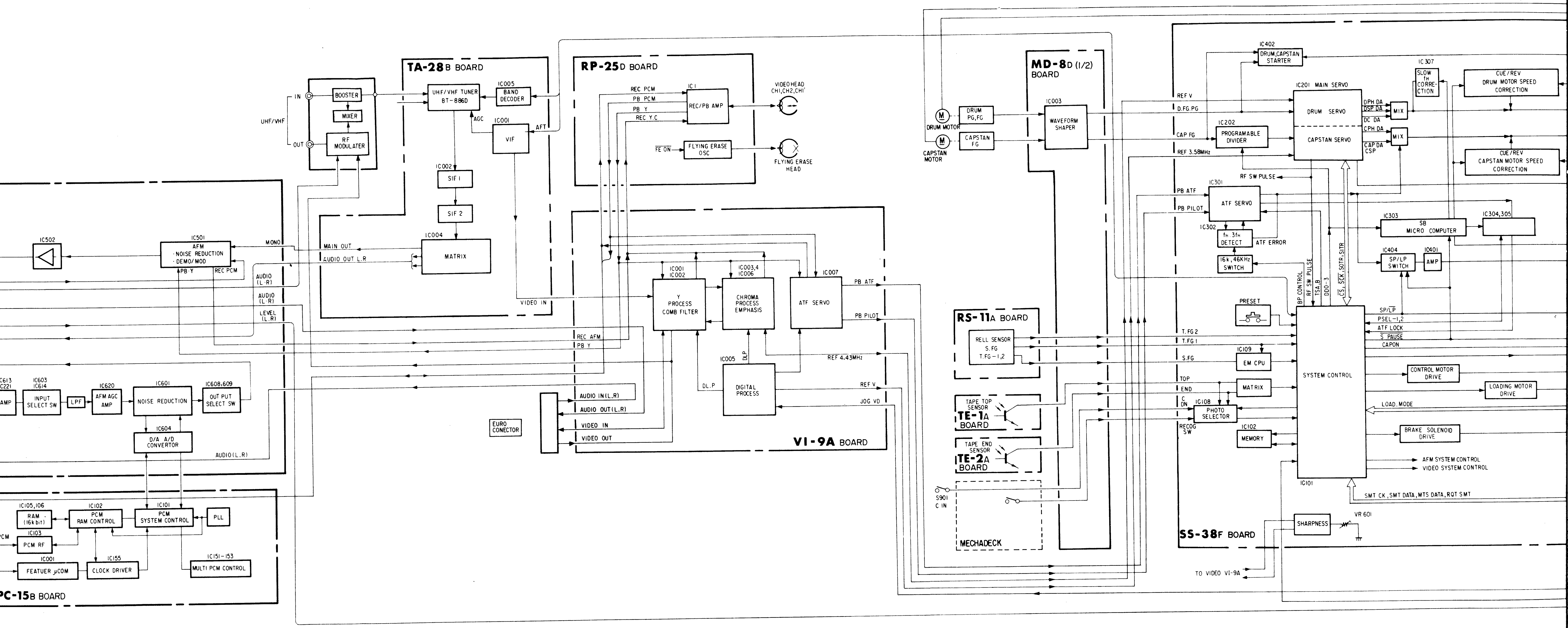
3-1. CIRCUIT BOARDS LOCATION
[Australian Model]

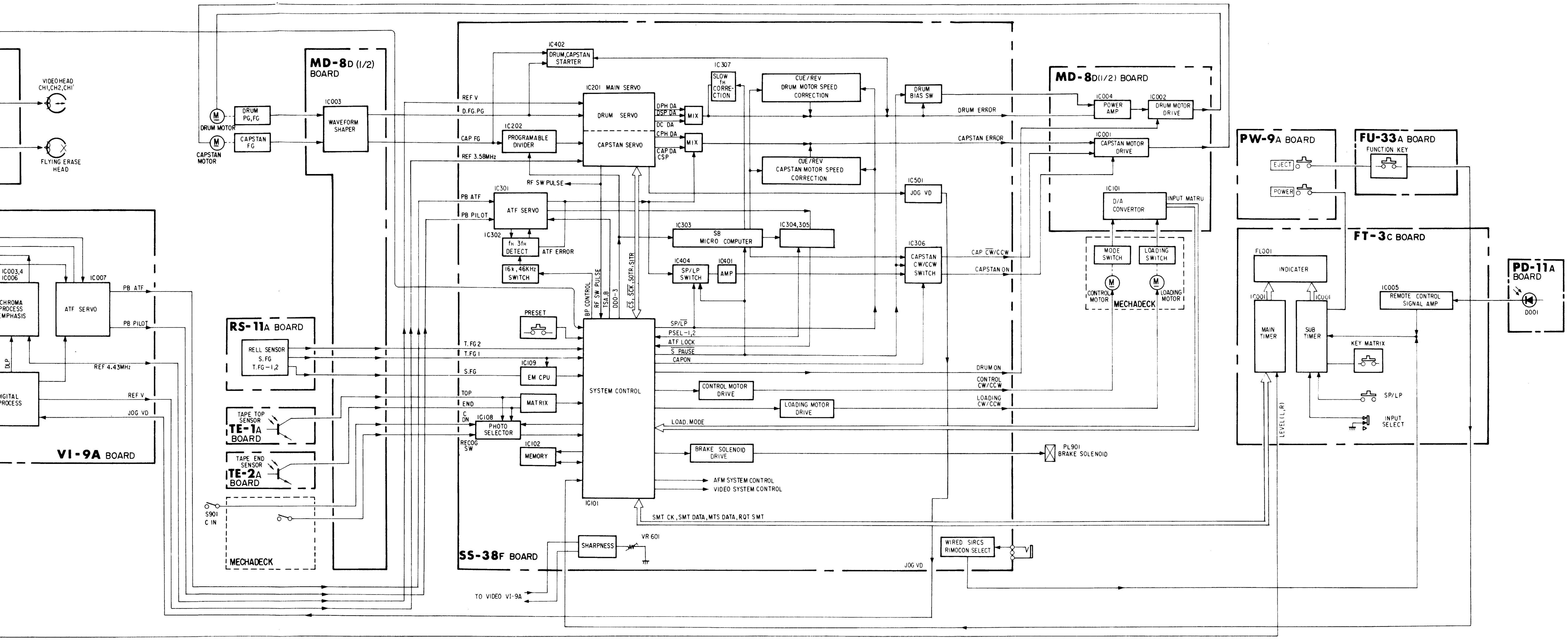


3-2. OVERALL BLOCK DIAGRAM [Australian Model]



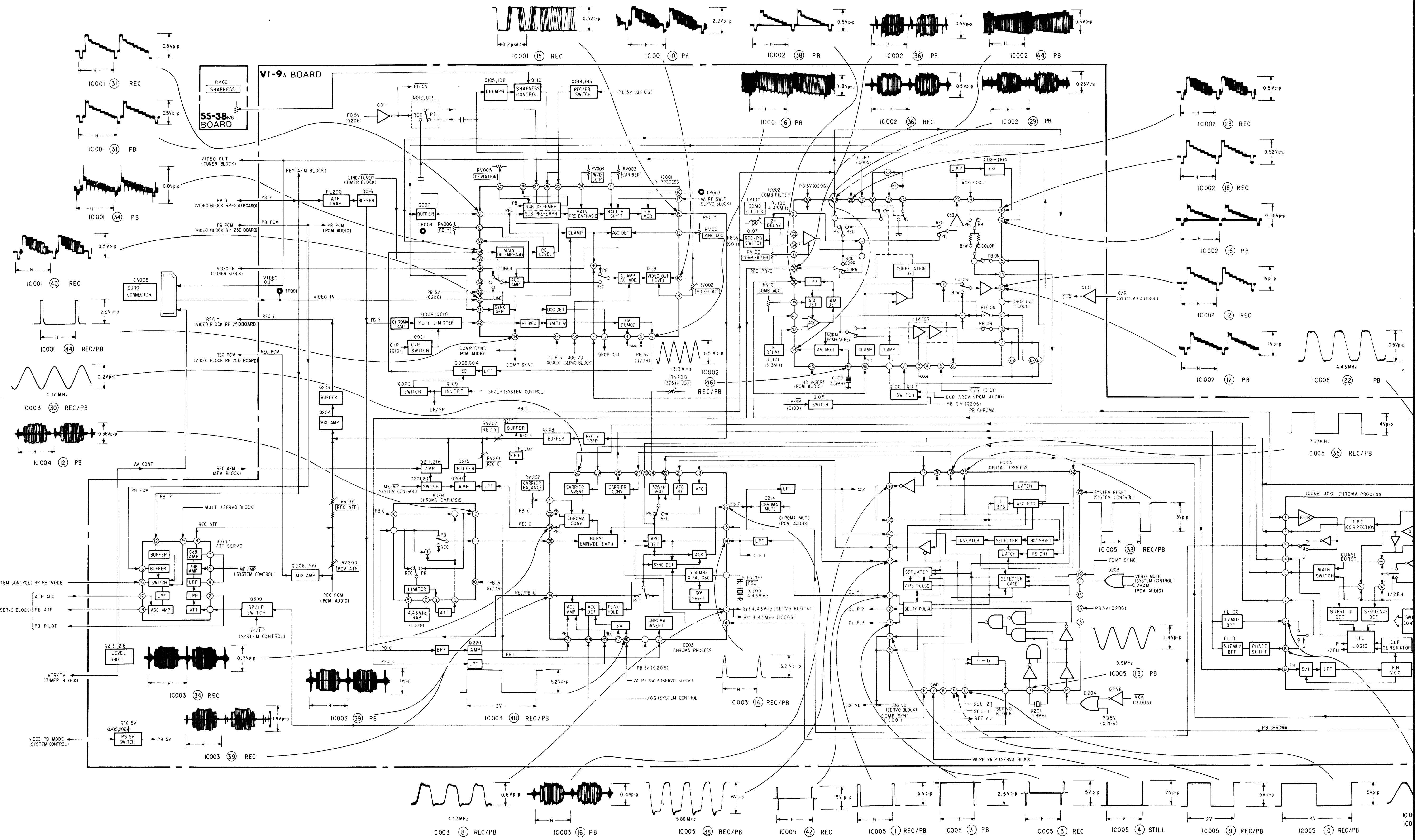
Model]

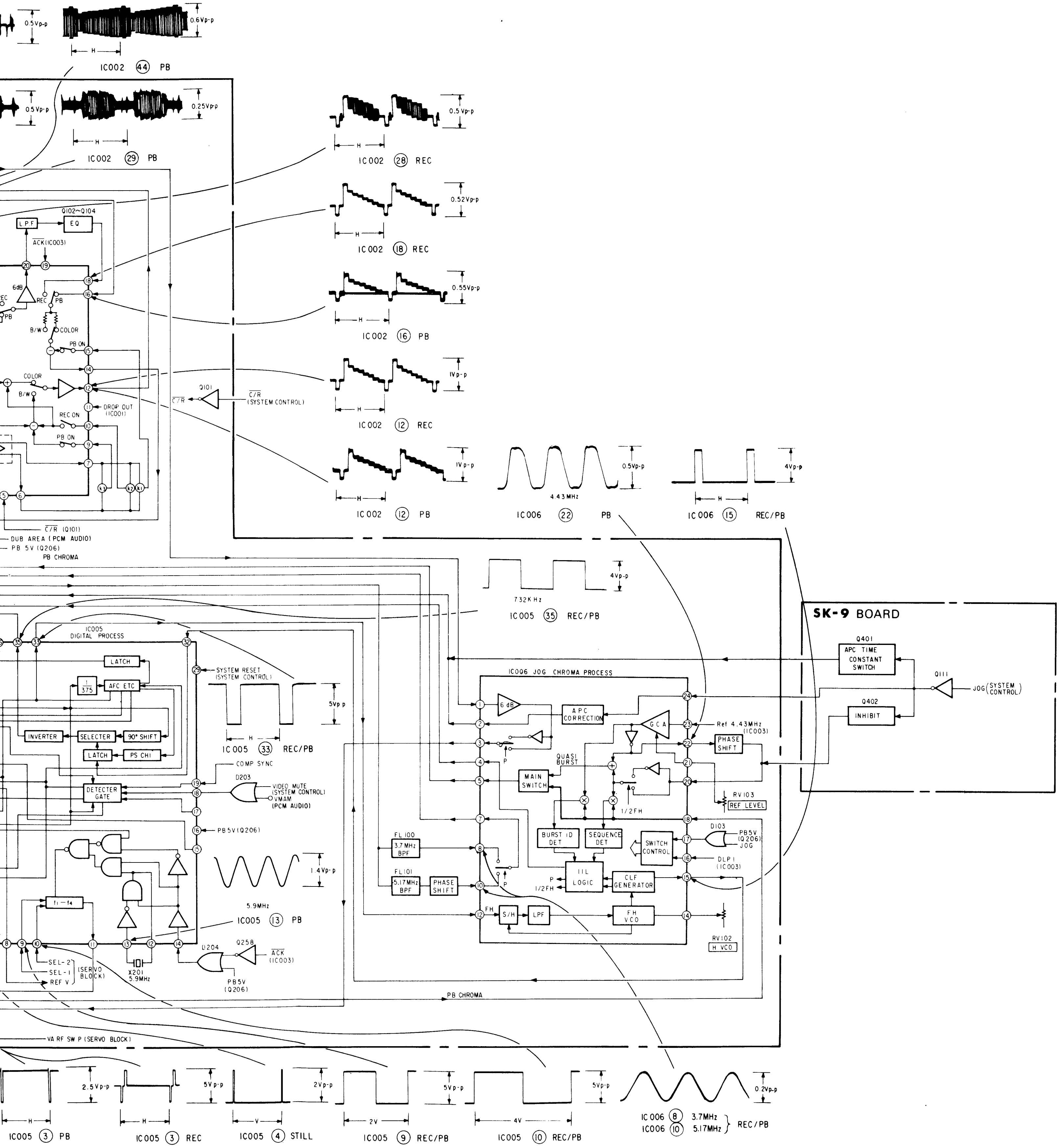

TA-28B BOARD
RP-25D BOARD
MD-8D (1/2) BOARD
VI-9A BOARD
RS-11A BOARD
TE-1A BOARD
TE-2A BOARD
SS-38F BOARD
PC-15B BOARD
MECHADECK
UHF/VHF TUNER BT-886D
BAND DECODER
BOOSTER
MIXER
RF MODULATER
VIF
SIF 1
SIF 2
MATRIX
REC/PB AMP
FLYING ERASE OSC
VIDEO HEAD CH1,CH2,CH1'
FLYING ERASE HEAD
AFM NOISE REDUCTION DEMO/MOD
Y PROCESS COMB FILTER
CHROMA PROCESS EMPHASIS
ATF SERVO
DIGITAL PROCESS
EURO CONECTOR
INPUT SELECT SW
AFM AGC AMP
NOISE REDUCTION
OUT PUT SELECT SW
D/A A/D CONVERTOR
PCM RAM CONTROL
PCM SYSTEM CONTROL
PCM RF
FEATUER μCOM
CLOCK DRIVER
MULTI PCM CONTROL
DRUM MOTOR
CAPSTAN MOTOR
WAVEFORM SHAPER
DRUM,CAPSTAN STARTER
DRUM SERVO
CAPSTAN SERVO
PROGRAMABLE DIVIDER
SLOW fH CORRECTION
CUE/REV DRUM MOTOR SPEED CORRECTION
CUE/REV CAPSTAN MOTOR SPEED CORRECTION
MICRO COMPUTER
SP/LP SWITCH
SYSTEM CONTROL
EM CPU
PHOTO SELECTOR
MEMORY
CONTROL MOTOR DRIVE
LOADING MOTOR DRIVE
BRAKE SOLENOID DRIVE
AFM SYSTEM CONTROL
VIDEO SYSTEM CONTROL
SHARPNESS
TO VIDEO VI-9A



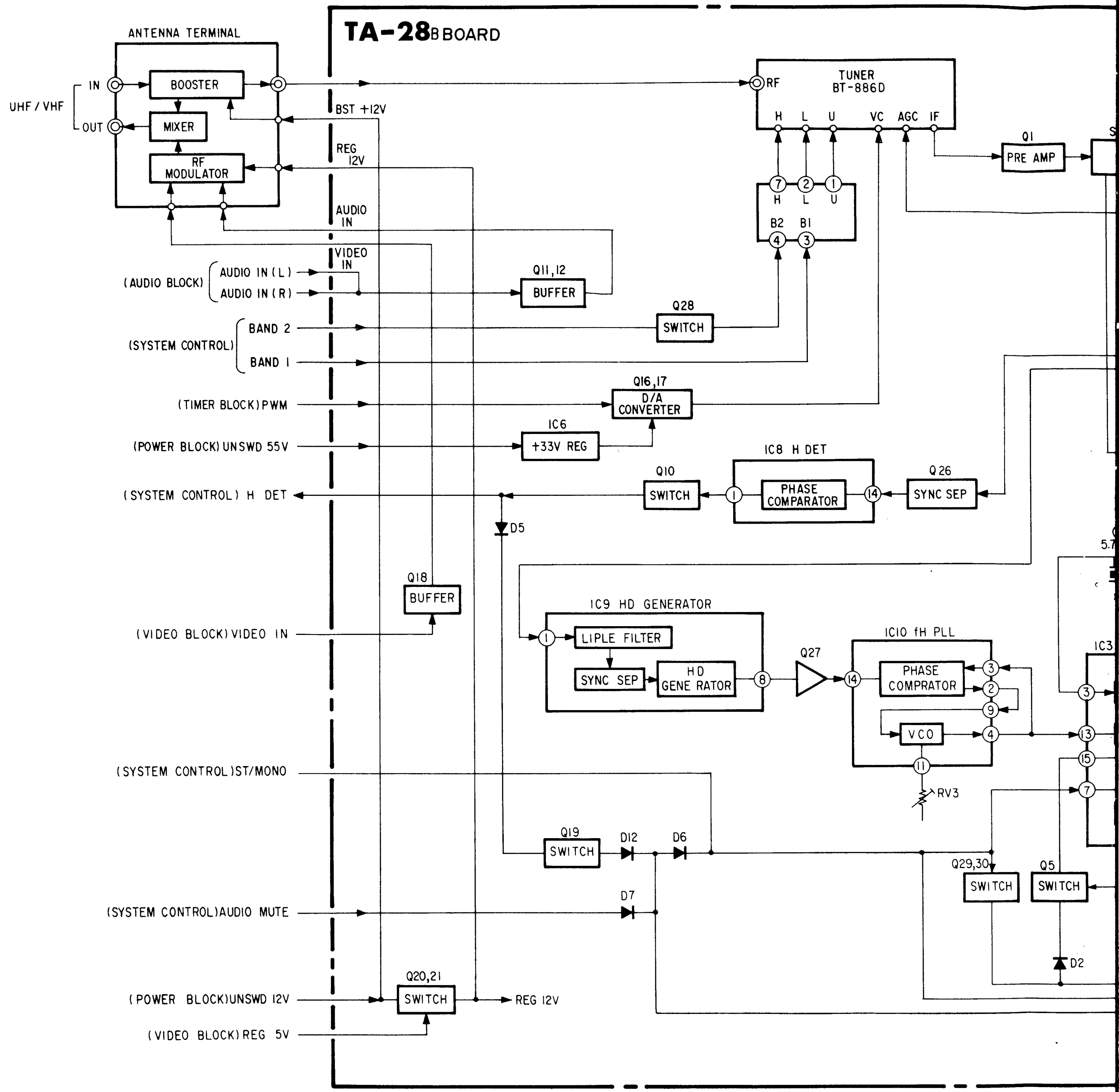
MD-8D (1/2) BOARD
SS-38F BOARD
MD-8D(1/2) BOARD
PW-9A BOARD
FU-33A BOARD
FT-3C BOARD
PD-11A BOARD
RS-11A BOARD
TE-1A BOARD
TE-2A BOARD
VI-9A BOARD
MECHADECK
DRUM MOTOR
CAPSTAN MOTOR
VIDEO HEAD CH1,CH2,CH1'
FLYING ERASE HEAD
WAVEFORM SHAPER
DRUM CAPSTAN STARTER
IC201 MAIN SERVO
DRUM SERVO
CAPSTAN SERVO
PROGRAMABLE DIVIDER
ATF SERVO
SYSTEM CONTROL
SB MICRO COMPUTER
CUE/REV DRUM MOTOR SPEED CORRECTION
CUE/REV CAPSTAN MOTOR SPEED CORRECTION
DRUM BIAS SW
JOG VD
CAPSTAN CW/CCW SWITCH
POWER AMP
DRUM MOTOR DRIVE
CAPSTAN MOTOR DRIVE
D/A CONVERTOR
MODE SWITCH
LOADING SWITCH
CONTROL MOTOR
LOADING MOTOR
EM CPU
MATRIX
PHOTO SELECTOR
MEMORY
CONTROL MOTOR DRIVE
LOADING MOTOR DRIVE
BRAKE SOLENOID DRIVE
PL901 BRAKE SOLENOID
AFM SYSTEM CONTROL
VIDEO SYSTEM CONTROL
SHARPNESS
VR 601
WIRED SIRCS RIMOCON SELECT
TO VIDEO VI-9A
INDICATER
MAIN TIMER
SUB TIMER
KEY MATRIX
REMOTE CONTROL SIGNAL AMP
EJECT
POWER
FUNCTION KEY
SP/LP
INPUT SELECT
CHROMA PROCESS EMPHASIS
DIGITAL PROCESS

3-3. VIDEO BLOCK DIAGRAM (2) [AEP/UK/Australian Model]

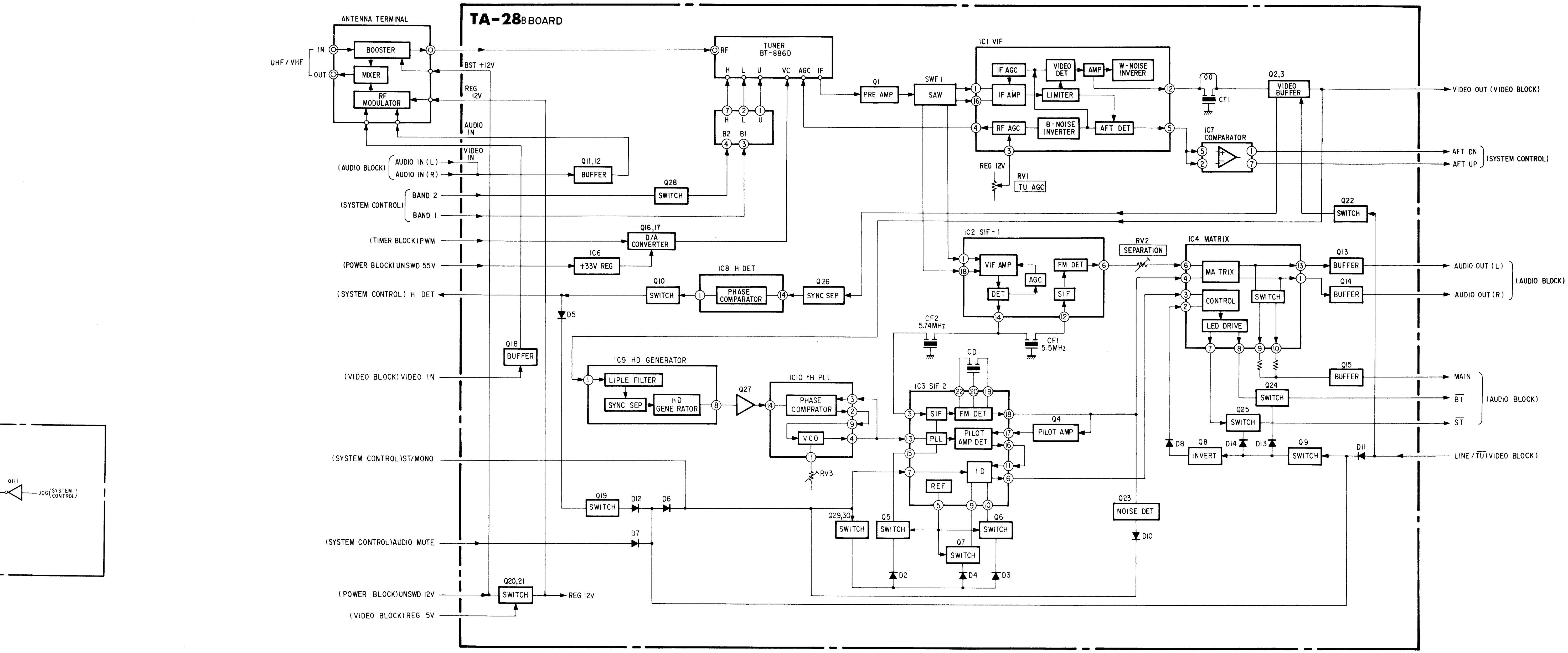




3-4. TUNER BLOCK DIAGRAM [Australian Model]

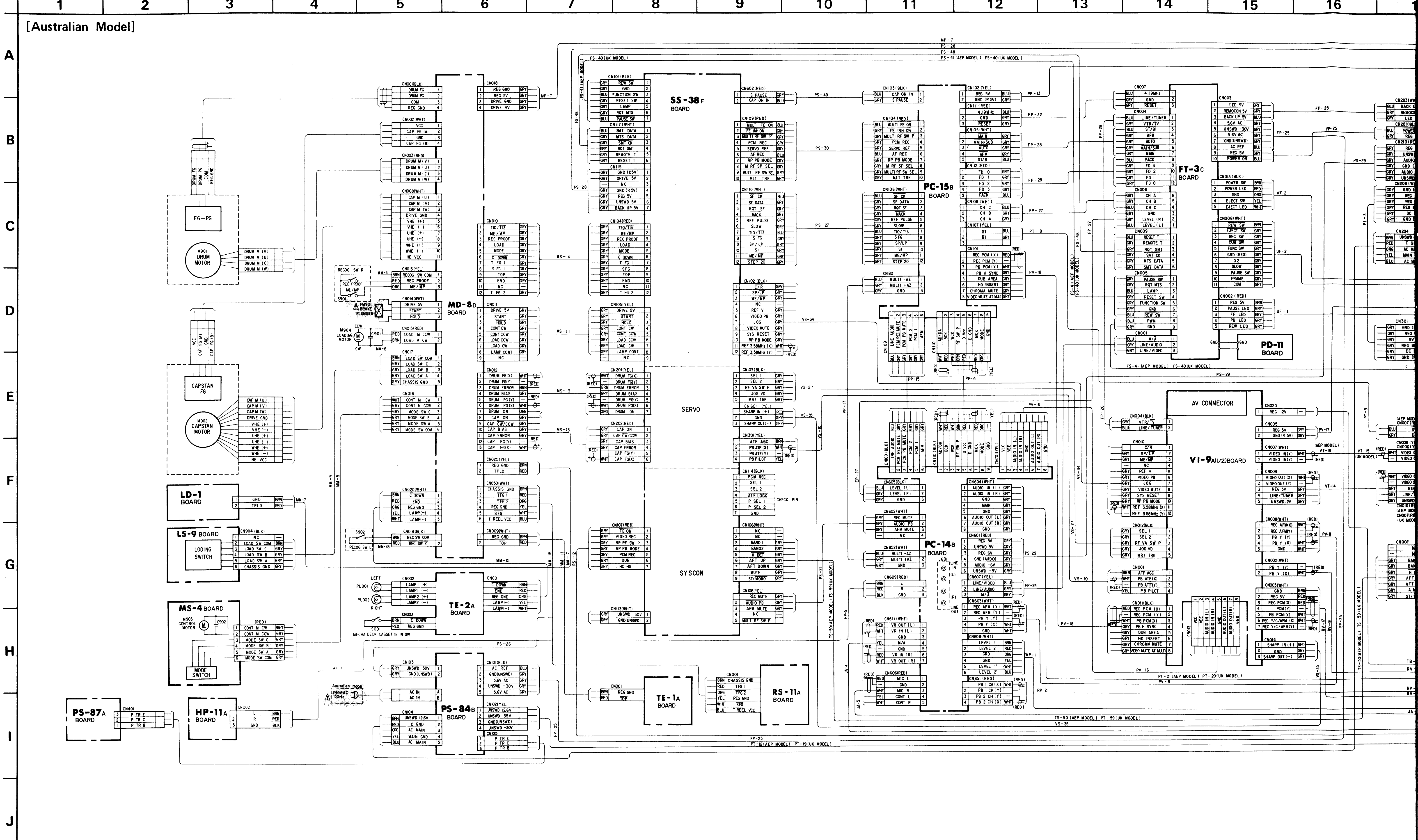


3-4. TUNER BLOCK DIAGRAM [Australian Model]

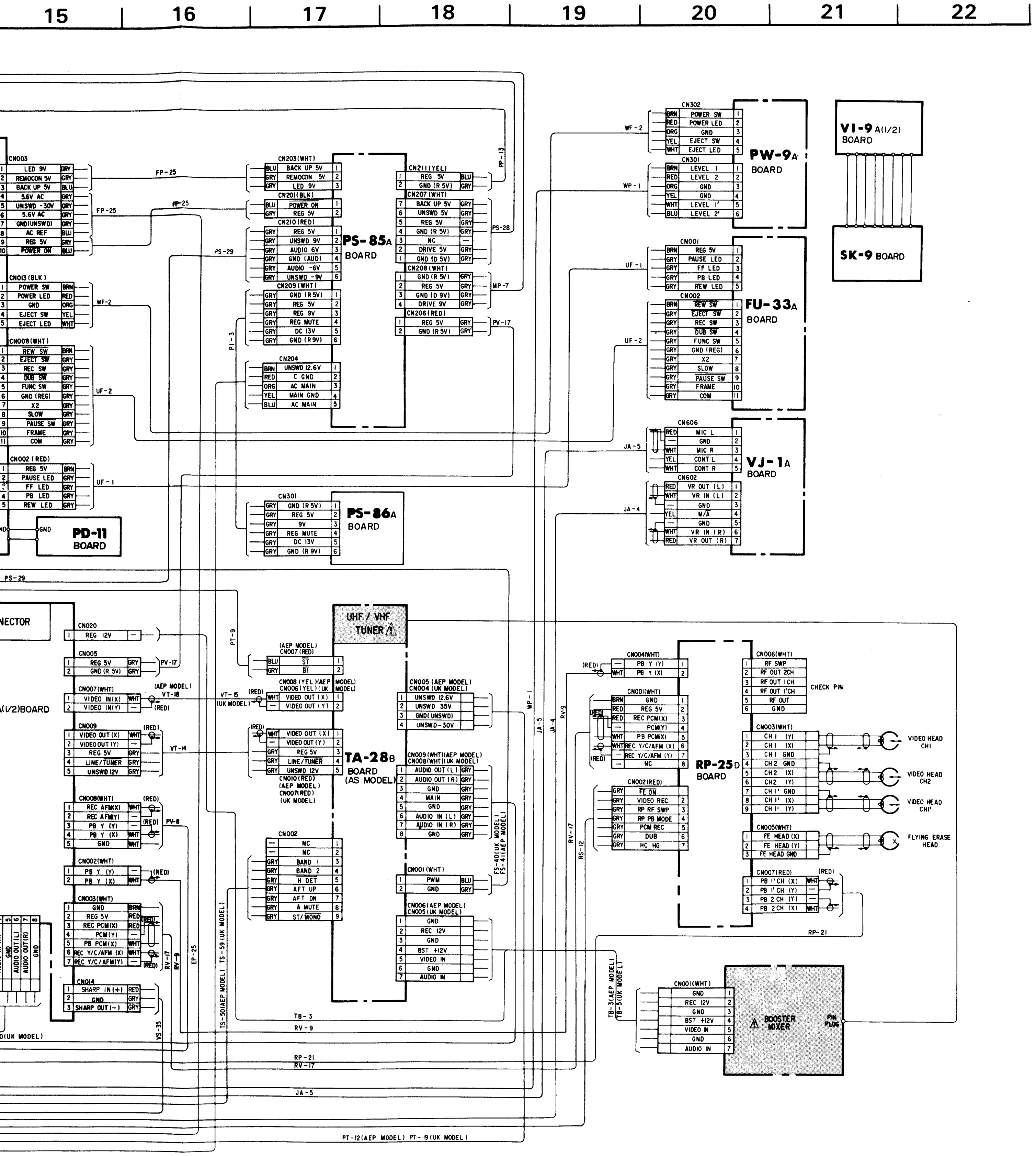


4. SCHEMATIC DIAGRAMS AND PRINTED WIRING BOARDS

4-1. Frame Schematic Diagram



FRAME



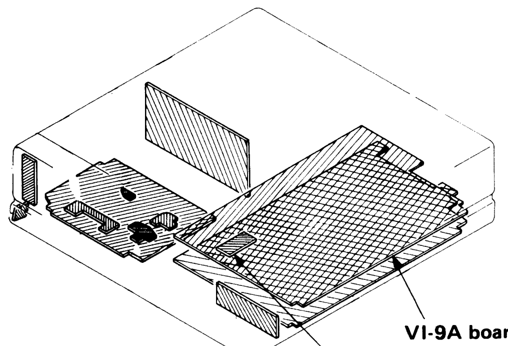
Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

VI-9A (VIDEO BOARD) SK-9 PRINTED WIRING BOARD

- All capacitors are in μF unless otherwise noted, pF : μμF 50WV or less are not indicated except for electrolytics and tantalums.
- All resistors are in ohms, 1/6W unless otherwise noted. kΩ : 1000Ω, MΩ : 1000kΩ.
- All variable and semi-fixed resistors have characteristics curve B, unless otherwise noted.
- : nonfiammable resistor.
- : fusible resistor.
- : panel disignation.
- : adjustment for repair.
- : B + bus.
- : B − bus.
- The voltage value is a reference value between the grounding when the color bar signal is received from a color bar generator.
- All voltage are dc measured with a VOM (10MΩ)

Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

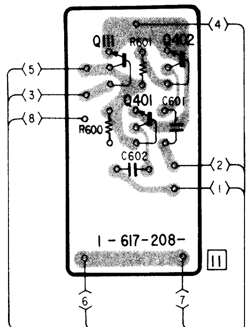


- ○— : parts extracted from the component side.
- ●— : parts extracted from the conductor side.
- : conductor side pattern.
- : B + pattern.
- Digital transistor (VI-9A: Q002, 011, 014, 015, 017, 021, 100, 101, 107, 108, 109, 201, 205, 207, 213, 214, 218, 258, 300, SK-9: Q401) transistor with resistors. Refer to the VI-9A, SK-9 boards schematic diagrams for digital transistor.

– Ref. NO. VI-9A BOARD, SK-9 BOARD: 1000 series –

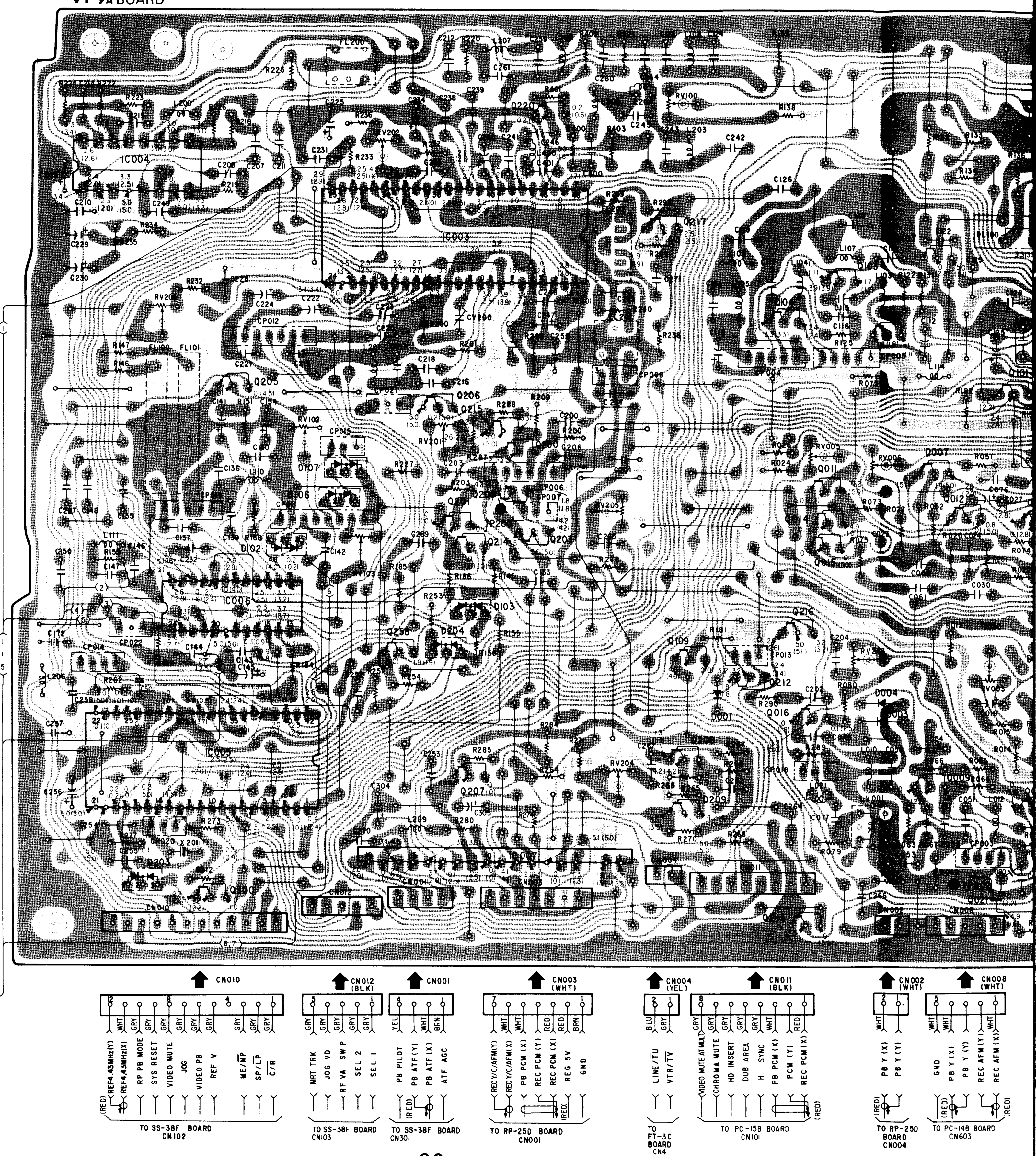
	IC, Q	D	ADJ	TP
B	220, IC004		101, 100, 202	
C	IC003, 217, 107, IC002, 103, 002, 104		206	
D	102, 100, 110, 205, 101, 108, 206, 215, 106, 105	104, 105	201, 102	
E	200, 007, 011, 204, 012, 013, 017, 201, 014, 015, 203, 214	107, 010, 106, 002, 102, 006	005, 006, 205, 103	200, 001
F	IC006, IC001, 216, 258, 109, 004	005, 103, 009, 204	203, 003	
G	016, 003, IC005, 208, 207, 009, 010, 008, 209	001, 008, 004, 003	004, 001, 204	003, 002
H	IC007, IC008, 300, 021, 213, 218	200, 203	002	202

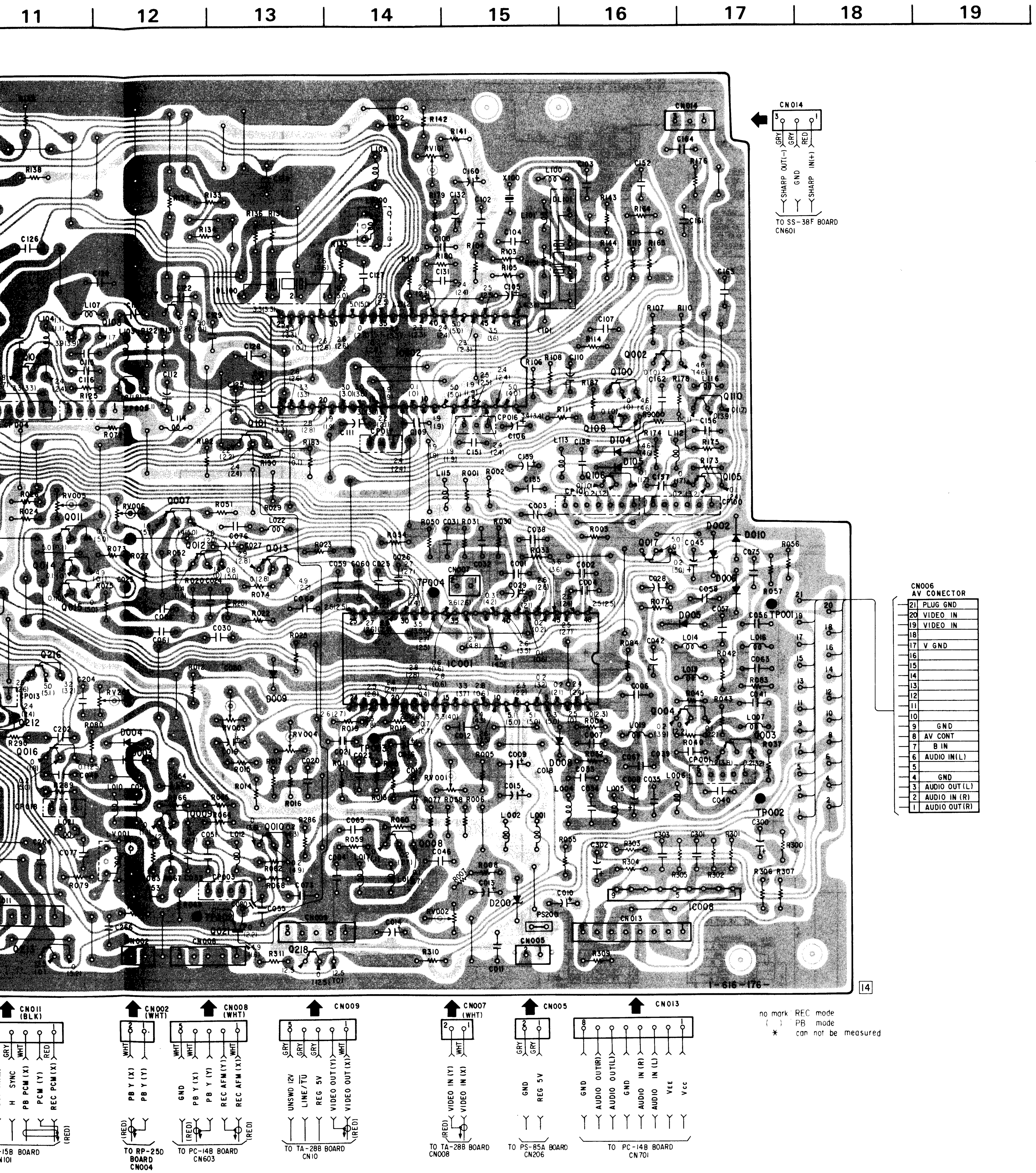
SK-9 BOARD



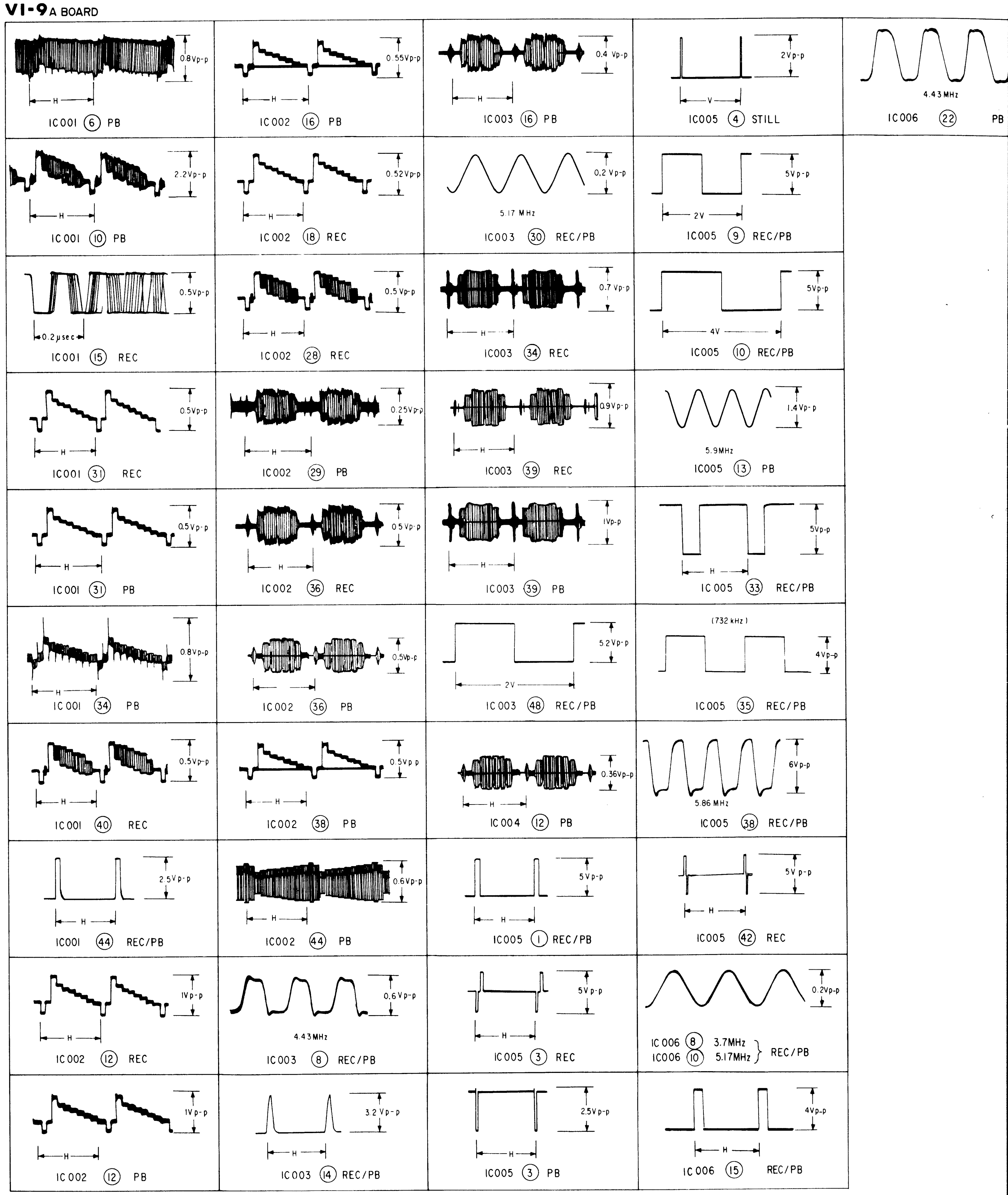
[AEP/UK/Australian Model]

VI-9A BOARD




11
12
13
14
15
16
17
18
19
CN014
GRY GRY RED
SHARP OUT(-) GND SHARP IN(+)
TO SS-38F BOARD CN601
CN006 AV CONECTOR
21 PLUG GND
20 VIDEO IN
19 VIDEO IN
17 V GND
9 GND
8 AV CONT
7 B IN
6 AUDIO IN(L)
4 GND
3 AUDIO OUT(L)
2 AUDIO IN (R)
1 AUDIO OUT(R)
IC001
1-616-176-
14
CN011 (BLK)
CN002 (WHT)
PB Y (X)
PB Y (Y)
TO RP-250 BOARD CN004
CN008 (WHT)
GND
PB Y (X)
PB Y (Y)
REC AFM (Y)
REC AFM (X)
TO PC-148 BOARD CN603
CN009
UNSWD 12V
LINE/TU
REG 5V
VIDEO OUT (Y)
VIDEO OUT (X)
TO TA-288 BOARD CN10
CN007 (WHT)
VIDEO IN (Y)
VIDEO IN (X)
TO TA-288 BOARD CN008
CN005
GND
REG 5V
TO PS-85A BOARD CN206
CN013
GND
AUDIO OUT(R)
AUDIO OUT(L)
GND
AUDIO IN (R)
AUDIO IN (L)
Vcc
Vcc
TO PC-148 BOARD CN701
no mark REC mode
( ) PB mode
* can not be measured

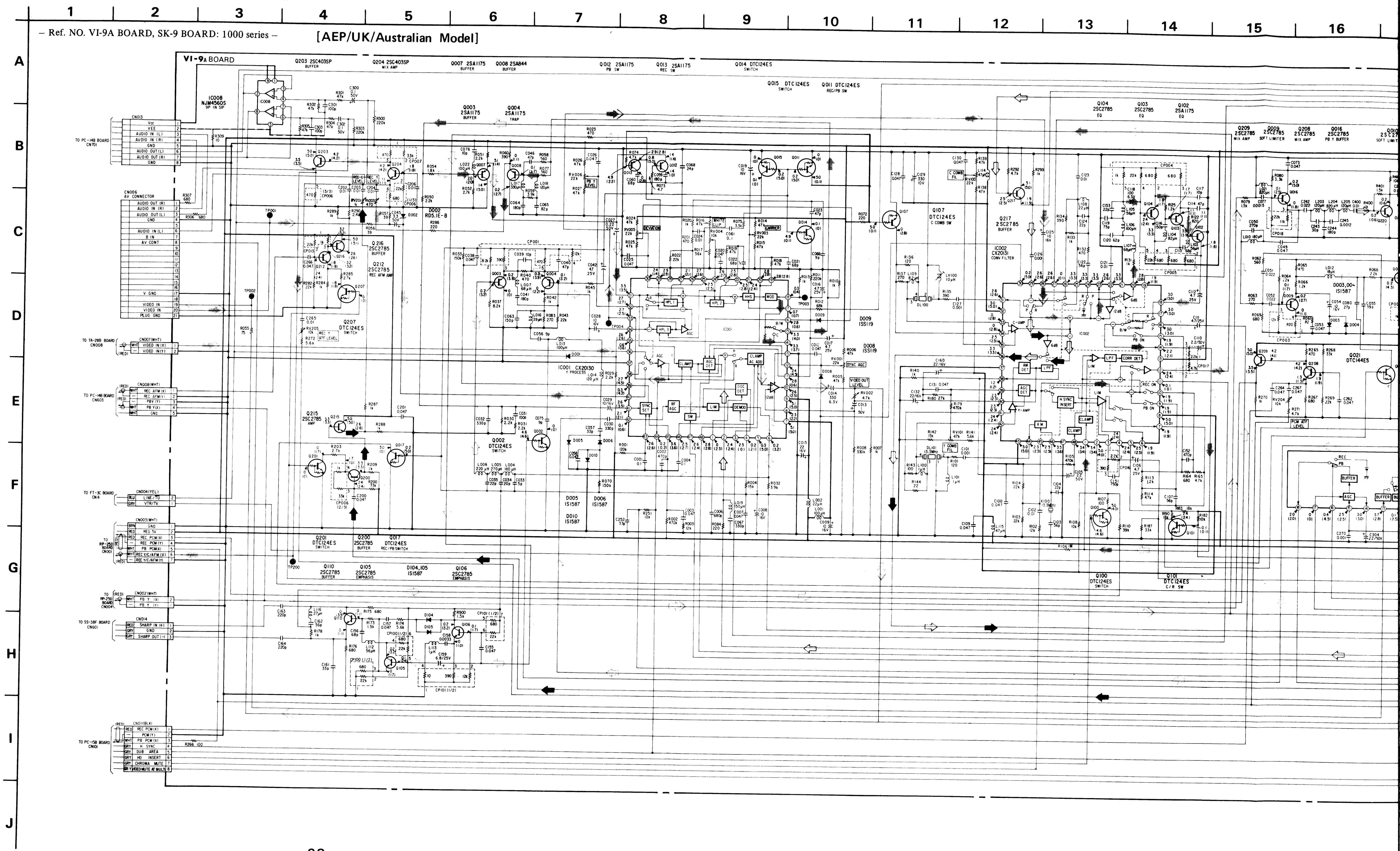
VI-9A BOARD

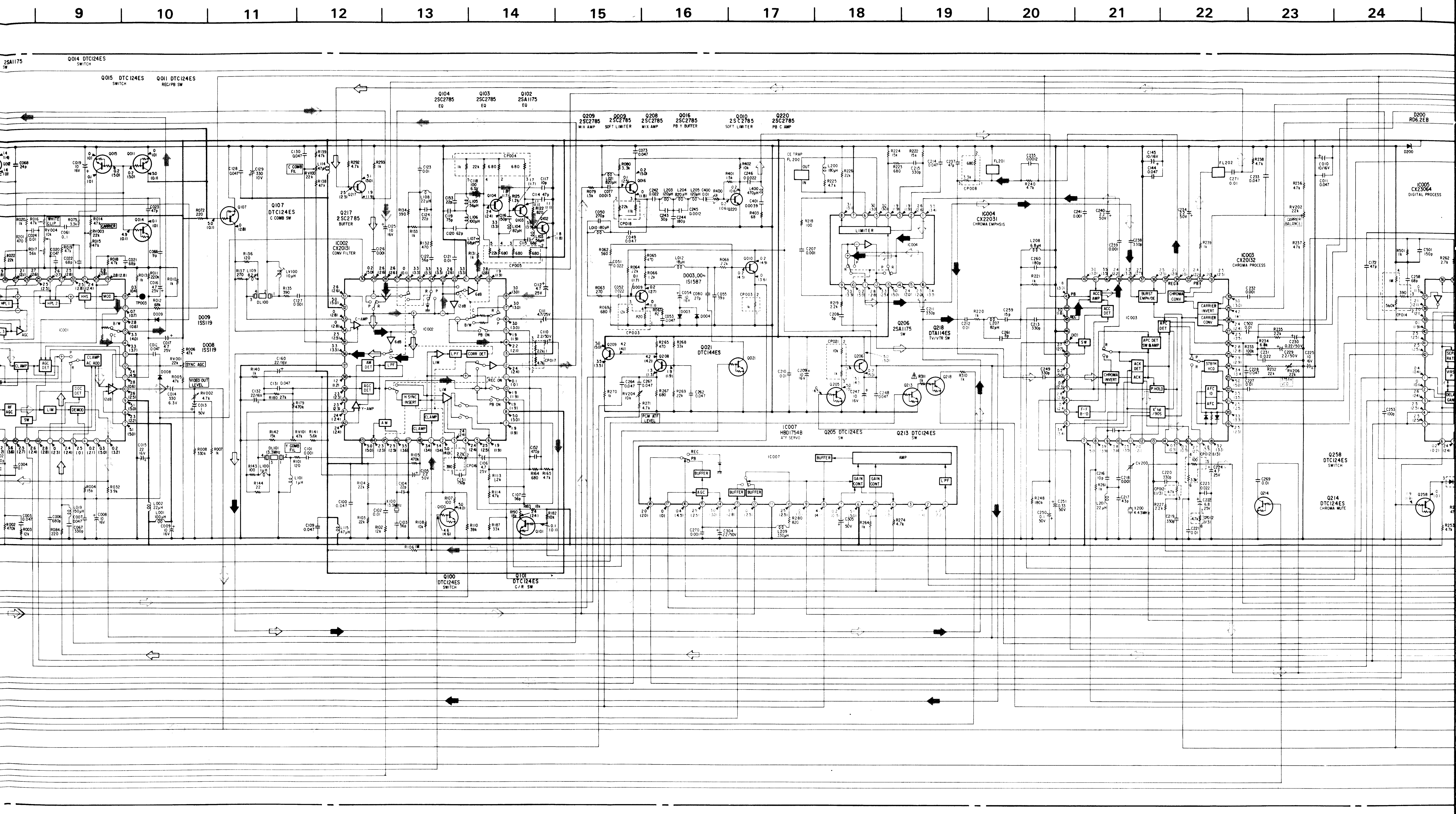

IC001 (6) PB 0.8Vp-p H
IC002 (16) PB 0.55Vp-p H
IC003 (16) PB 0.4 Vp-p H
IC005 (4) STILL 2Vp-p V
IC006 (22) PB 4.43MHz
IC001 (10) PB 2.2Vp-p H
IC002 (18) REC 0.52Vp-p H
IC003 (30) REC/PB 0.2 Vp-p 5.17 MHz
IC005 (9) REC/PB 5Vp-p 2V
IC001 (15) REC 0.5Vp-p 0.2μsec
IC002 (28) REC 0.5Vp-p H
IC003 (34) REC 0.7 Vp-p H
IC005 (10) REC/PB 5Vp-p 4V
IC001 (31) REC 0.5Vp-p H
IC002 (29) PB 0.25Vp-p H
IC003 (39) REC 0.9Vp-p H
IC005 (13) PB 1.4Vp-p 5.9MHz
IC001 (31) PB 0.5Vp-p H
IC002 (36) REC 0.5Vp-p H
IC003 (39) PB 1Vp-p H
IC005 (33) REC/PB 5Vp-p H
IC001 (34) PB 0.8Vp-p H
IC002 (36) PB 0.5Vp-p
IC003 (48) REC/PB 5.2Vp-p 2V
IC005 (35) REC/PB 4Vp-p (732 kHz)
IC001 (40) REC 0.5Vp-p H
IC002 (38) PB 0.5Vp-p H
IC004 (12) PB 0.36Vp-p H
IC005 (38) REC/PB 6Vp-p 5.86 MHz
IC001 (44) REC/PB 2.5Vp-p H
IC002 (44) PB 0.6Vp-p H
IC005 (1) REC/PB 5Vp-p H
IC005 (42) REC 5V p-p H
IC002 (12) REC 1Vp-p H
IC003 (8) REC/PB 0.6Vp-p 4.43MHz
IC005 (3) REC 5Vp-p H
IC006 (8) 3.7MHz
IC006 (10) 5.17MHz REC/PB 0.2Vp-p
IC002 (12) PB 1Vp-p H
IC003 (14) REC/PB 3.2 Vp-p H
IC005 (3) PB 2.5Vp-p H
IC006 (15) REC/PB 4Vp-p H

VI-9A (VIDEO BOARD) SK-9 SCHEMATIC DIAGRAM

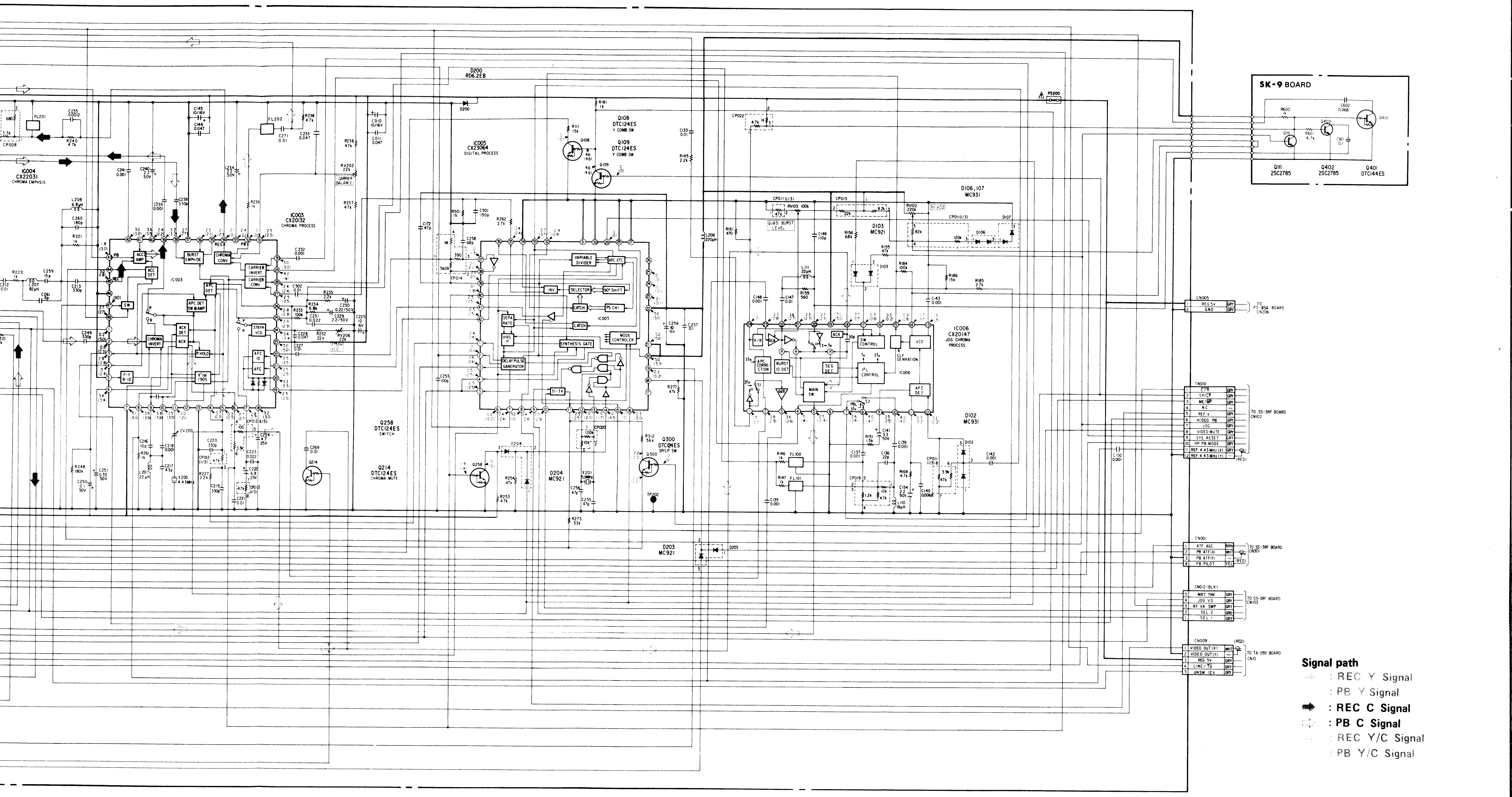
– Ref. NO. VI-9A BOARD, SK-9 BOARD: 1000 series –

[AEP/UK/Australian Model]





20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35



Signal path

: REC Y Signal

: PB Y Signal

: REC C Signal

: PB C Signal

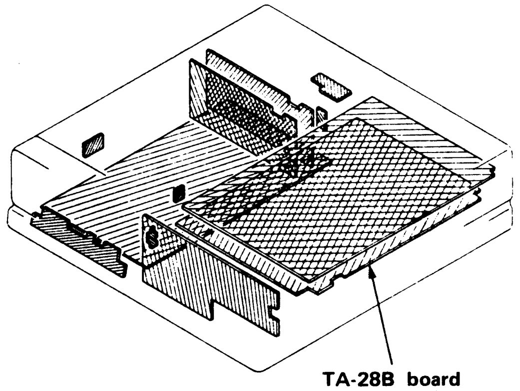
: REC Y/C Signal

: PB Y/C Signal

TA-28B (TUNER/VIF/MPX BOARD) PRINTED WIRING BOARD

- ○— : parts extracted from the component side.
- ●— : parts extracted from the conductor side.
- ▇ : conductor side pattern.
- ░ : B + pattern.

- Digital transistor (TA-28B: Q5, 6, 7, 8, 9, 20, 22, 27, 28, 29, 30) transistor with resistors.
  Refer to the TA-28B board schematic diagram for digital transistor.



TA-28B board

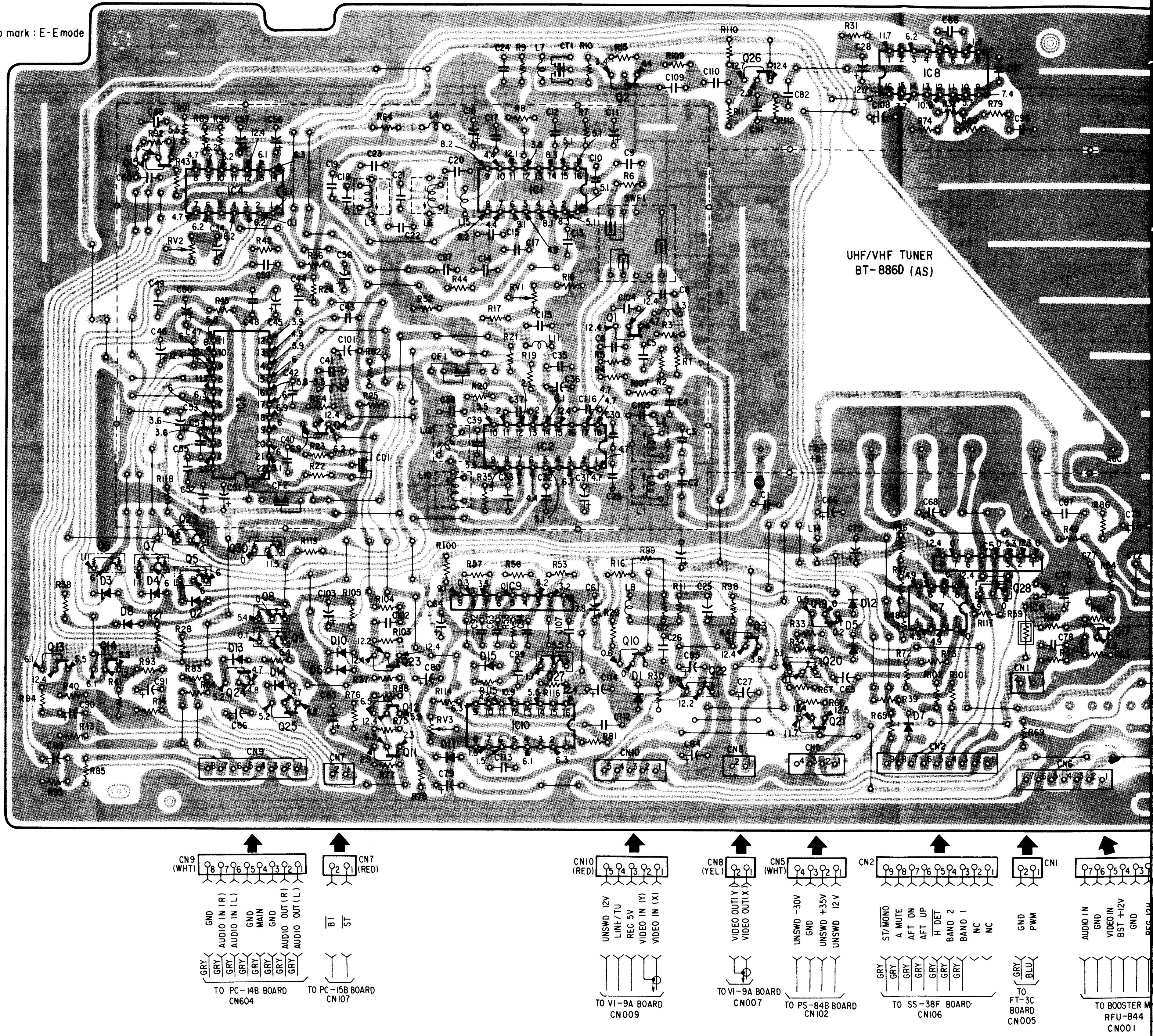
– Ref. No. TA-28B BOARD: 6000 series –

[Australian Model]

Row	Q , IC	D	ADJ
B	IC8, 2, 26		
C	15, IC4, IC1		RV2
D	1		RV1
E	IC3, 4, IC2		
F	29, 30, 6, 7, IC5, 16, 5, 28, IC6, IC9, IC7	3, 4, 2, 12	
G	8, 17, 9, 3, 27, 20, 13, 14, 23, 24, 22, 18, 25, 12, 21	8, 5, 10, 13, 6, 15, 14, 1, 7	
H	IC10, 11	11	RV3

TA-28 B BOARD

no mark : E-E mode



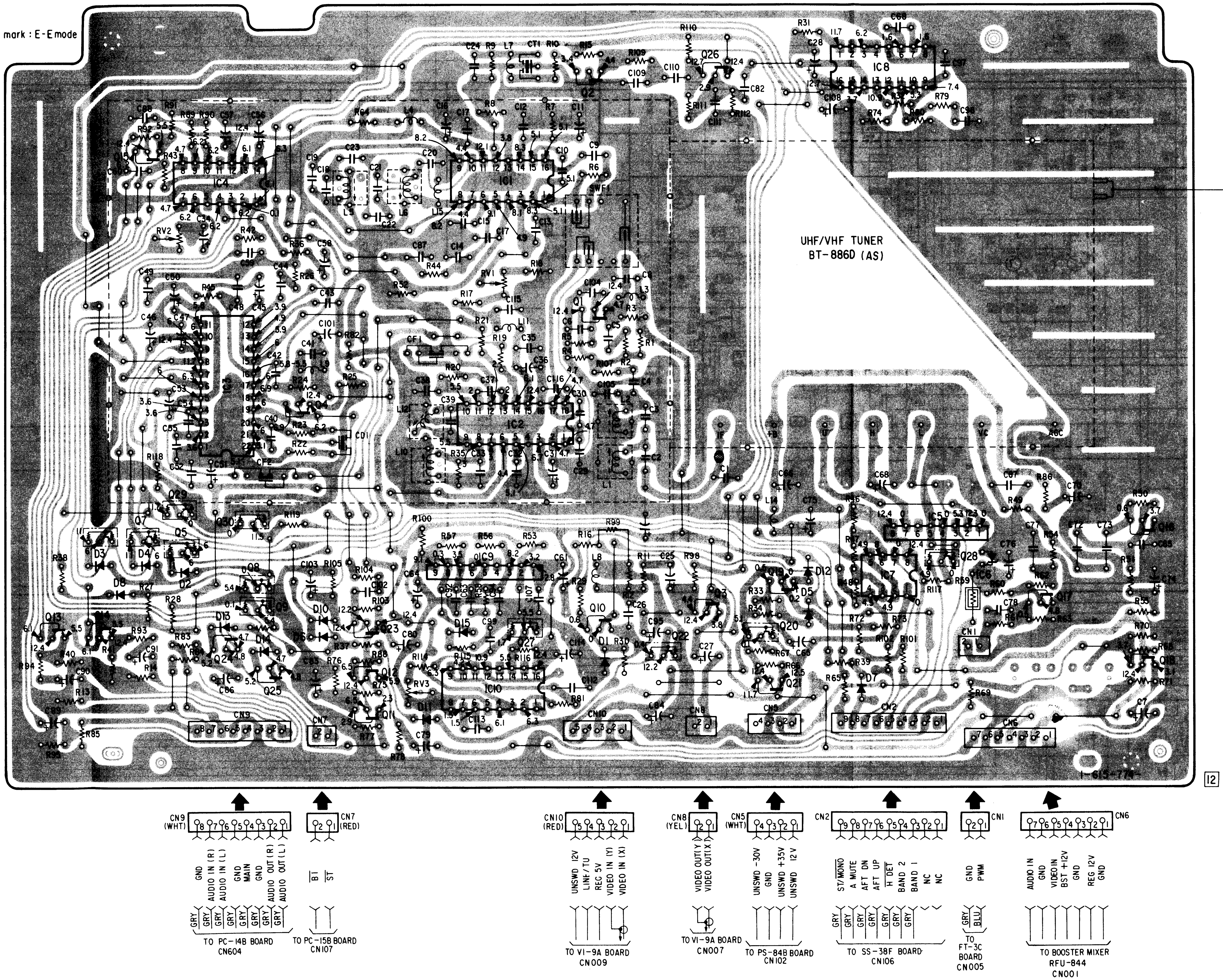
BOARD) PRINTED WIRING BOARD

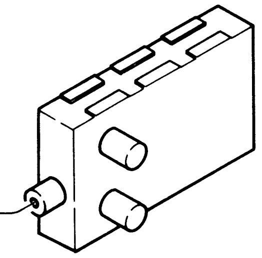
| 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |

6000 series – [Australian Model]

D	ADJ
	RV2
	RV1
3,4,12 / 2 / 8 / 5 / 10 / 13 6 15 / 14 1 / 7 / 11	RV3
D	ADJ

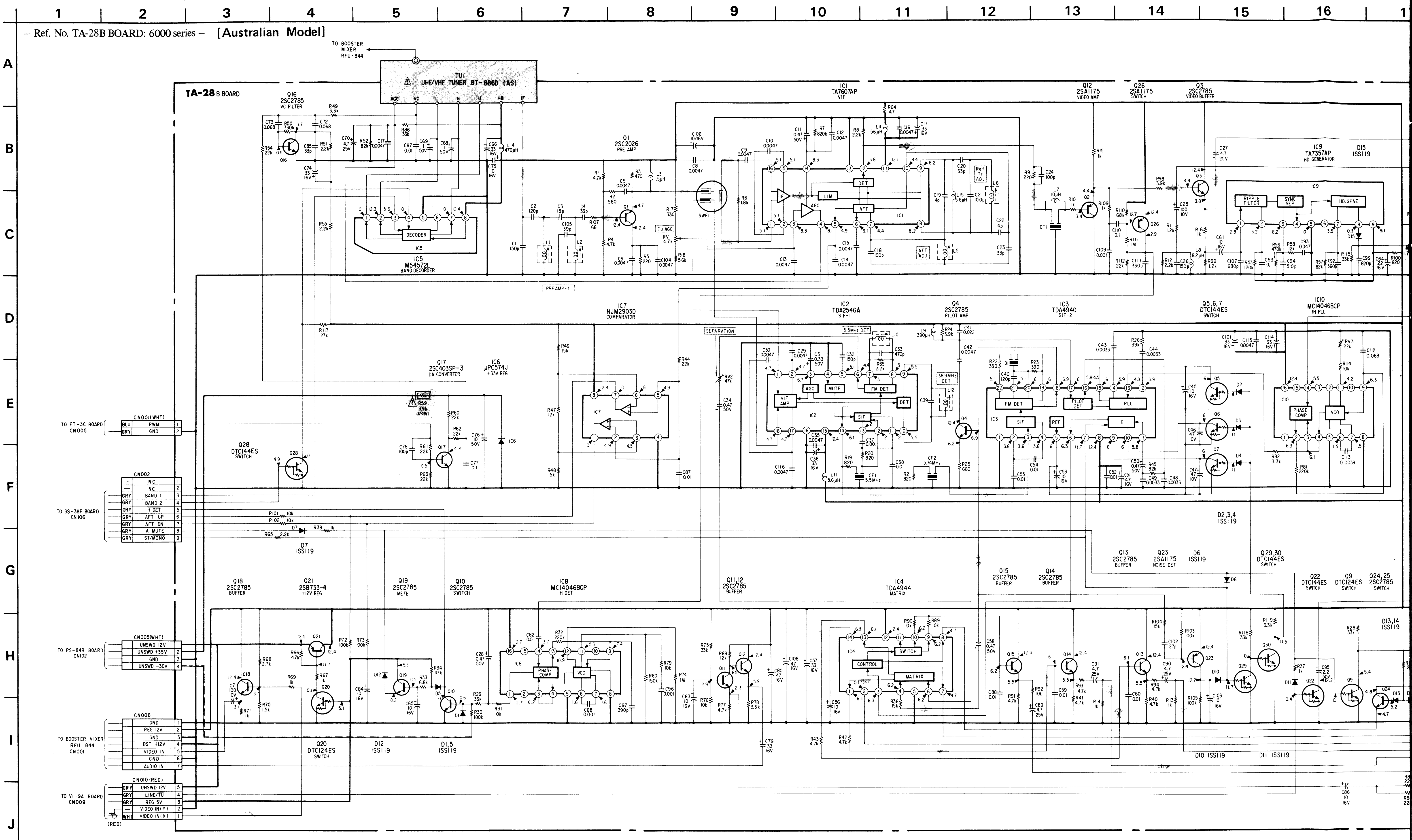
TA-28 B BOARD

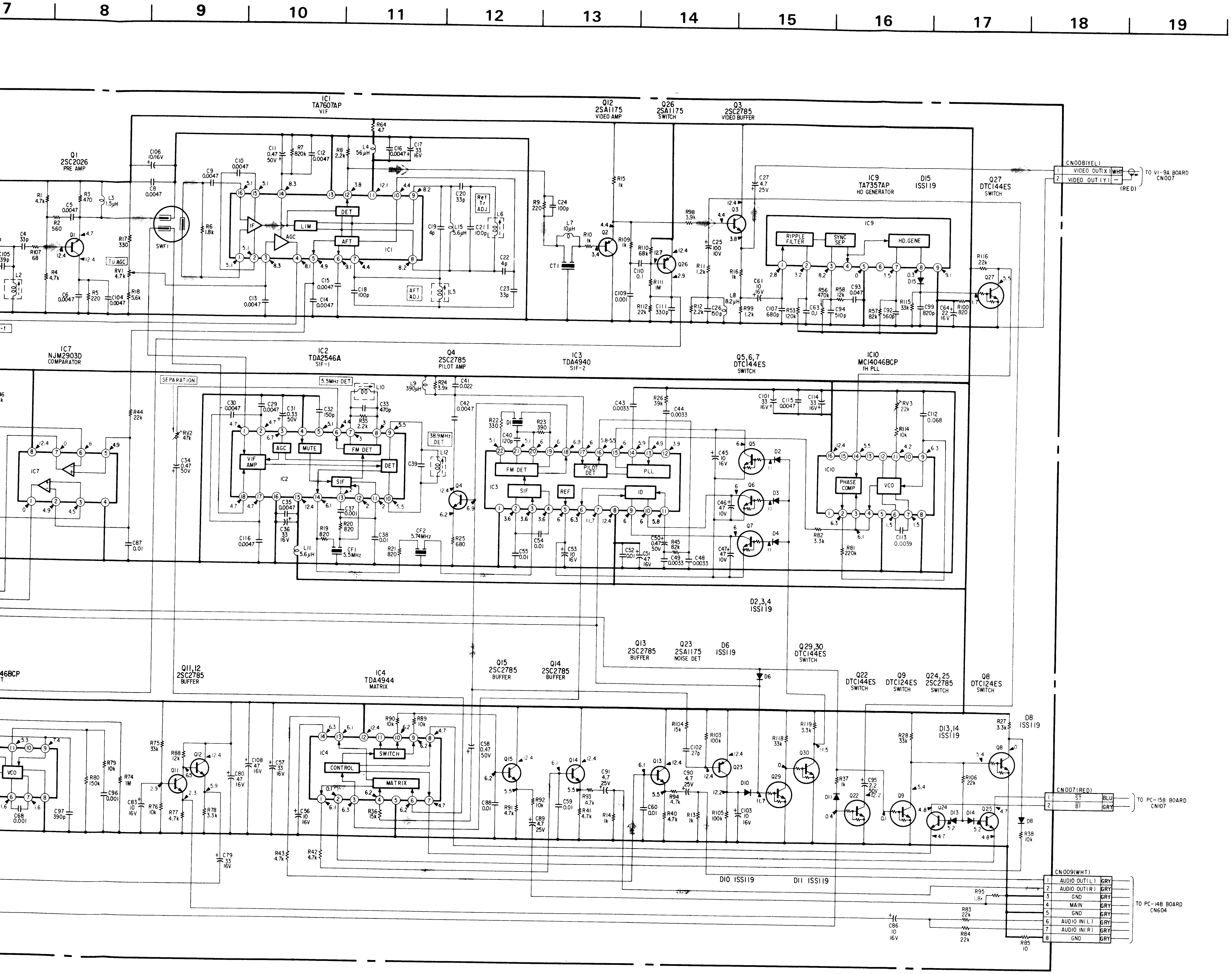




BOOSTER MIXER
RFU-844

TA-28B (TUNER/VIF/MPX BOARD) SCHEMATIC DIAGRAM





- All capacitors are in μF unless otherwise noted, pF : μμF 50WV or less are not indicated except for electrolytics and tantalums.
- All resistors are in ohms, 1/6W unless otherwise noted. kΩ : 1000Ω, MΩ : 1000kΩ.
- All variable and semi-fixed resistors have characteristics curve B, unless otherwise noted.
- : nonfiammable resistor.
- : fusible resistor.
- : panel disignation.
- : adjustment for repair.
- : B + bus.
- : B – bus.
- The voltage value is a reference value between the grounding when the color bar signal is received from a color bar generator.
- All voltage are dc measured with a VOM (10MΩ)

Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

Signal path

: REC Y/C Signal

: PB Y/C Signal

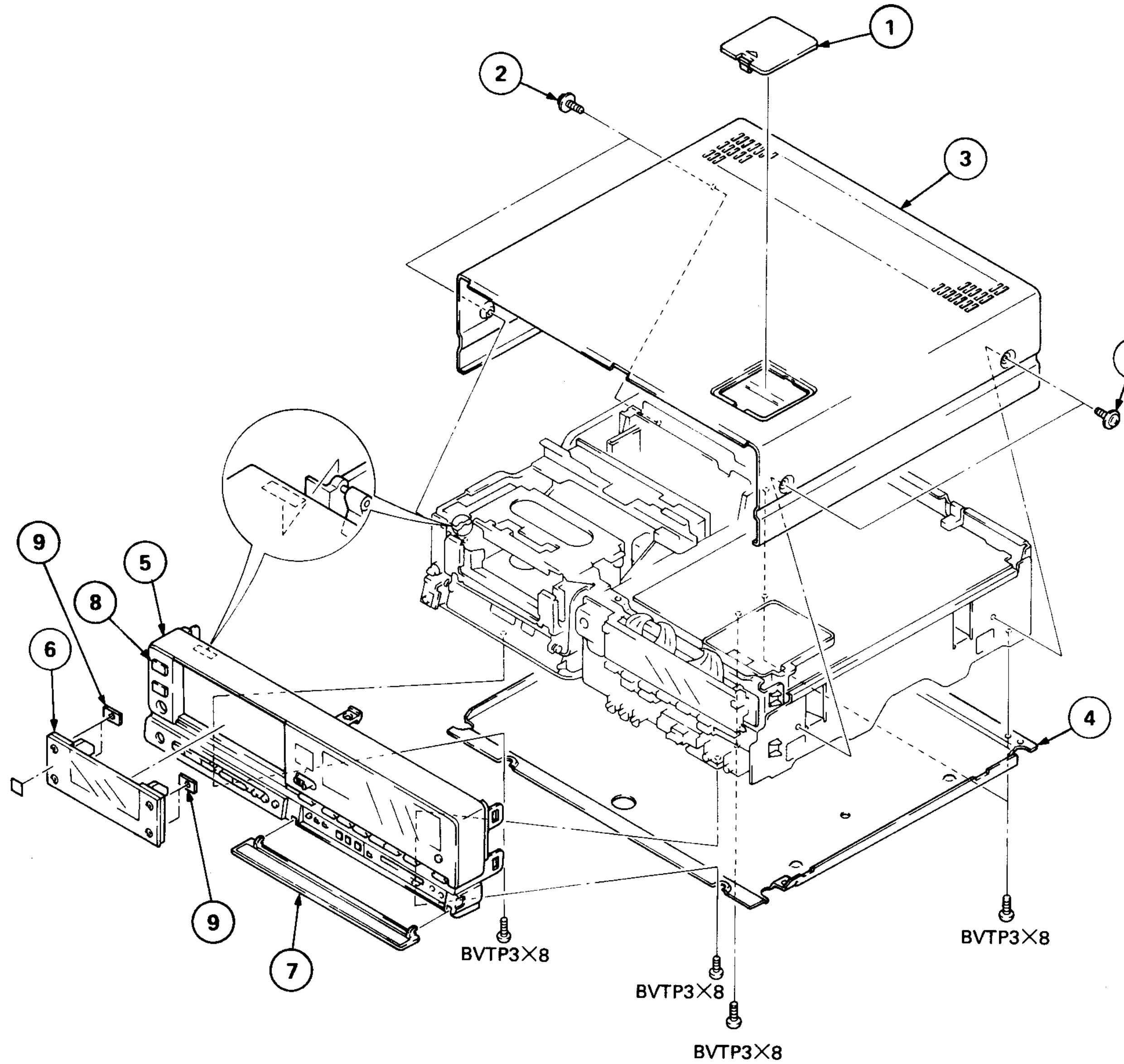
5. EXPLODED VIEWS

NOTE:

- Itmes with no part number and no description are not stocked because they are seldom required for routine service.
- The construction parts of an assembled part are indicated with a collation number in the remark column.
- Items marked "*" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.
- The mechanical parts with no reference number in the exploded views are not supplied.

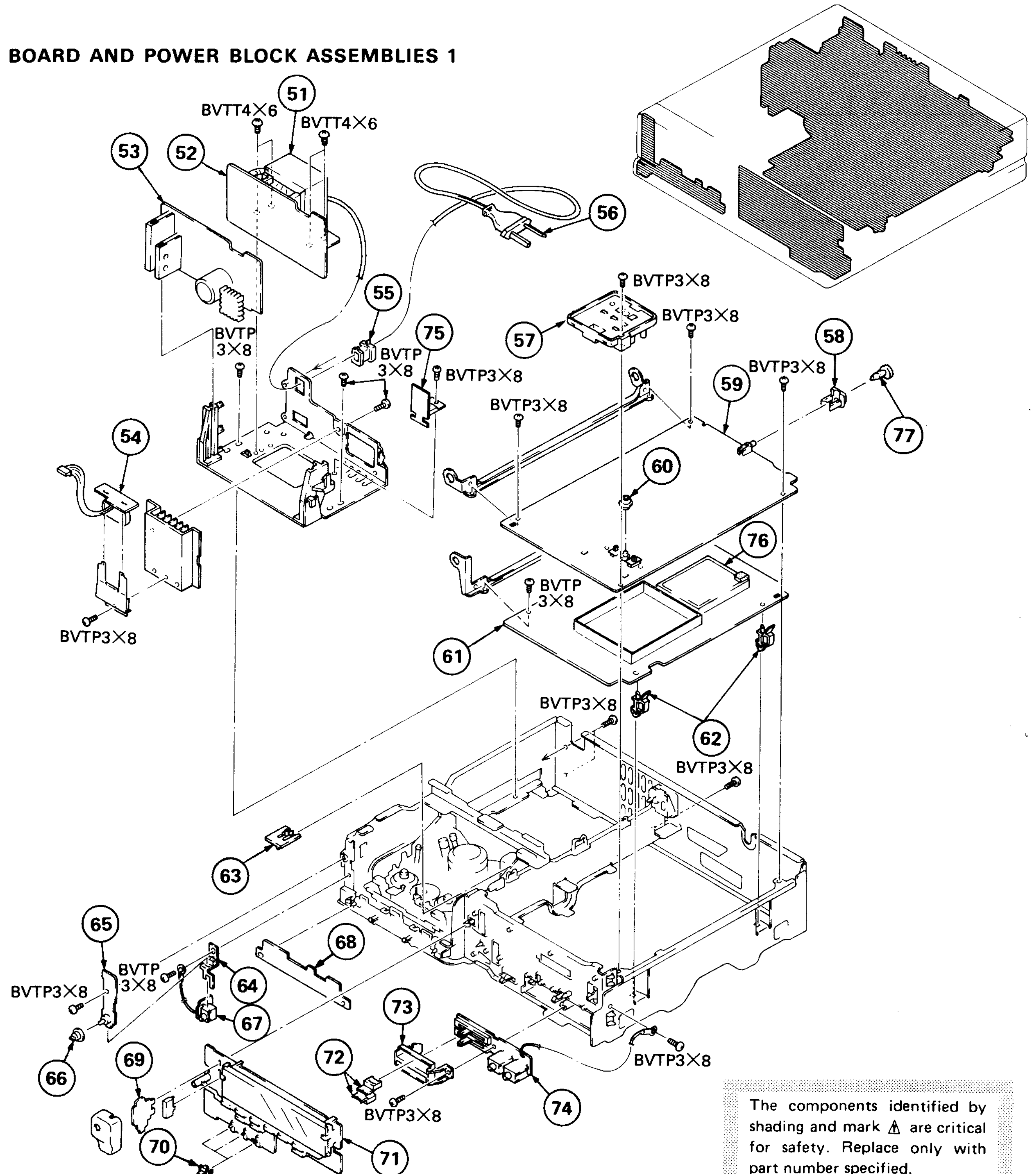
The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

5-1. FRONT PANEL AND CASE (UPPER, LOWER) ASSEMBLIES



No.	Part No.	Description	Remark
1	*2-352-647-01	LID, PRESET	
2	4-886-821-01	SCREW, M3 CASE	
3	X-3689-529-1	CASE ASSY, UPPER	
4	*3-691-907-03	PLATE, BUTTOM	
5	X-3689-523-1	FRONT ASSY (HA)	8
6	X-3689-505-4	LID (H) ASSY	9
7	X-3689-544-1	DOOR ASSY (HAS), FRONT	
8	3-689-516-11	KEY, POWER	
9	*3-689-040-01	NUT, PLATE	

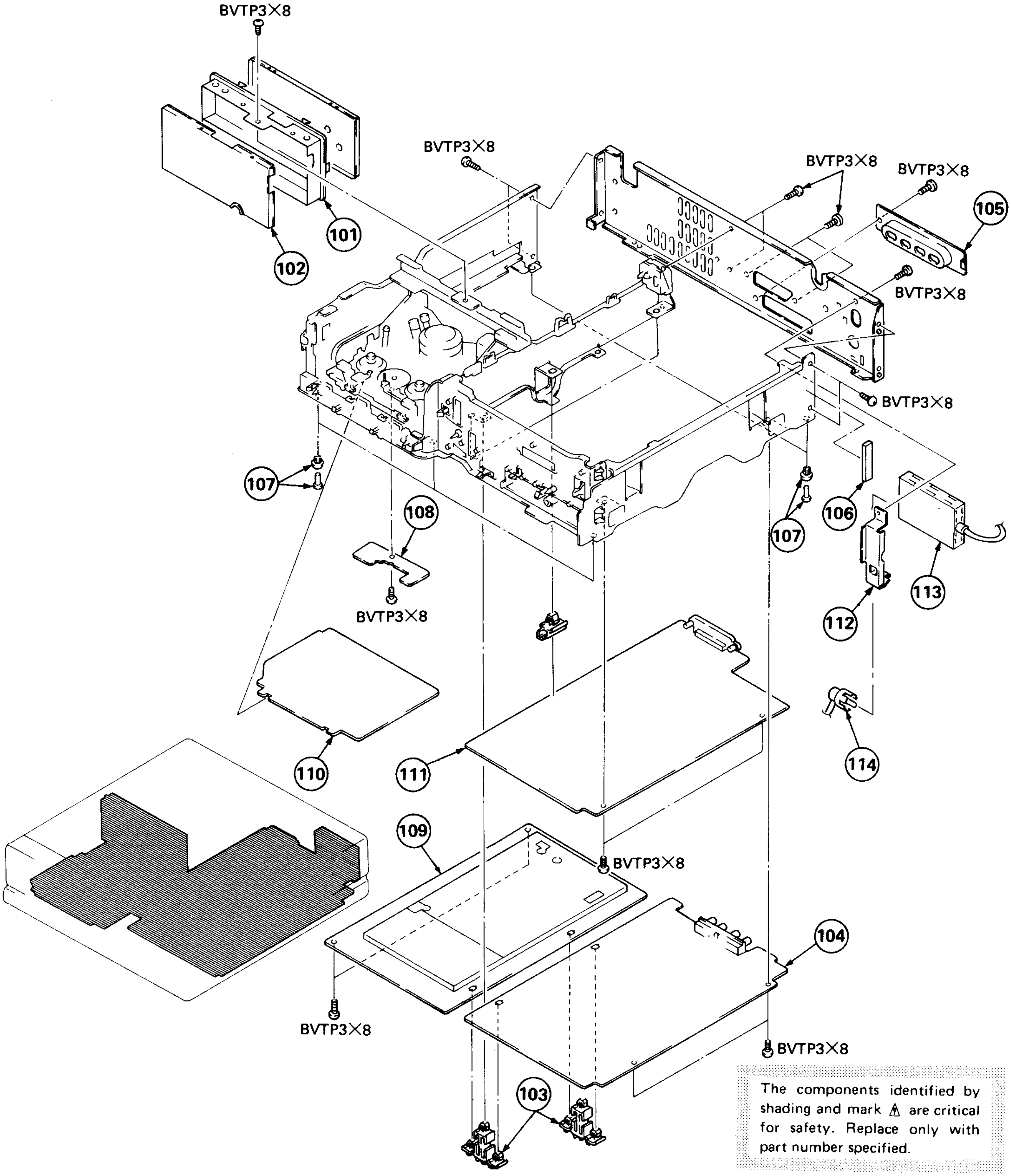
5-2. BOARD AND POWER BLOCK ASSEMBLIES 1



The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

No.	Part No.	Description	Remark
51	⚠.1-448-236-11	TRANSFORMER, POWER T101	
52	*A-7070-121-A	PS-84B BOARD, COMPLETE	
53	*A-7070-118-A	PS-85A BOARD, COMPLETE	
54	*1-616-185-11	PS-86A BOARD	
55	⚠.3-703-244-00	BUSHING (2104), CORD	
56	⚠.1-551-732-00	CORD,POWER	
57	X-3689-519-1	KEYBOARD ASSY, PRESET	
58	3-691-912-01	PLATE, ORNAMENTAL, REMOTE	
59	*A-7060-156-A	SS-38F BOARD, COMPLETE	
60	3-691-971-01	KNOB, SHARPNESS	
61	*A-7060-316-A	TA-28B BOARD, COMPLETE (Australian Model)	
62	*3-682-047-01	HOLDER (A), PC BOARD	
63	*3-691-916-01	COVER, CAP	
64	*3-696-807-01	HOLDER, HP JACK	
65	*1-615-714-14	PW-9A BOARD	
66	X-3689-515-1	KNOB ASSY, HP	
67	*A-7060-148-A	HP-11A BOARD, COMPLETE	
68	*1-615-717-11	FU-33A BOARD	
69	*1-615-718-11	PD-11A BOARD	
70	3-689-518-01	KEY, SLIDE	
71	*A-7060-158-A	FT-3C BOARD, COMPLETE	
72	3-689-519-01	KEY, VOL	
73	*3-689-536-01	GUIDE, SLIDE	
74	*1-615-715-11	VJ-1A BOARD	
75	*1-616-186-11	PS-87A BOARD	
76	⚠.1-463-661-21	TUNER, ET (BT-886D) (Australian Model)	
77	2-249-250-00	CLIP (SMALL) CANOE	

5-3. BOARD ASSEMBLY 2



The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

No.	Part No.	Description	Remark
101	*A-7060-160-A	RP-25D BOARD, COMPLETE	
102	*3-689-066-01	LID, SHIELD CASE, RP	
103	*3-682-081-00	HOLDER, PCB	
104	*A-7060-154-A	PC-14B BOARD, COMPLETE	
105	3-689-580-01	PLATE (HA), ORNAMENTAL, JACK	
106	4-864-324-11	SPACER	
107	3-670-155-11	LEG	
108	*1-615-309-11	RS-11A BOARD	

No.	Part No.	Description	Remark
109	*A-7060-159-A	PC-15B BOARD, COMPLETE	
110	*A-7060-132-A	MD-8D BOARD, COMPLETE	
111	*A-7060-155-A	VI-9A BOARD, COMPLETE	
112	*3-689-577-01	BRACKET (HA), ANTENNA	(AEP/UK/Australian Mode
113	⚠ 1-464-589-11	BOOSTER RF MODULATOR	RFU-844(AS)
114	*1-555-110-00	CABLE, PIN	

6. ELECTRICAL PARTS LIST

NOTE:

The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

- Due to standardization, replacements in the parts list may be different from the parts specified in the diagrams or the components used on the set.
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.

RESISTORS

- All resistors are in ohms
- F : nonflammable

- Items marked "*" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.

CAPACITORS

- MF : μF, PF : μμF

COILS

- MMH : mH, UH : μH

Ref.No	Part No.	Description			Remark
	*A-7060-155-A	VI-9A BOARD, COMPLETE (AEP/UK/Australian MODEL) **********************			
	1-123-330-00	ELECT	22MF	20%	10V
	1-562-838-21	JACK, PIN 4P			
		CAPACITOR			
C001	1-161-025-00	CERAMIC	0.1MF	10%	25V
C002	1-102-824-00	CERAMIC	470PF	5%	50V
C003	1-101-006-21	CERAMIC	0.047MF		50V
C004	1-161-025-00	CERAMIC	0.1MF	10%	25V
C006	1-102-116-00	CERAMIC	680PF	10%	50V
C007	1-101-006-21	CERAMIC	0.047MF		50V
C008	1-123-356-00	ELECT	10MF	20%	16V
C009	1-123-356-00	ELECT	10MF	20%	16V
C010	1-123-356-00	ELECT	10MF	20%	16V
C011	1-101-006-21	CERAMIC	0.047MF		50V
C012	1-101-006-21	CERAMIC	0.047MF		50V
C013	1-123-380-00	ELECT	1MF	20%	50V
C014	1-123-309-00	ELECT	330MF	20%	6.3V
C015	1-123-330-00	ELECT	22MF	20%	16V
C016	1-123-369-00	ELECT	4.7MF	20%	25V
C017	1-123-369-00	ELECT	4.7MF	20%	25V
C019	1-123-356-00	ELECT	10MF	20%	16V
C020	1-101-006-21	CERAMIC	0.047MF		50V
C021	1-101-890-21	CERAMIC	75PF	5%	50V
C022	1-101-888-00	CERAMIC	68PF	5%	50V
C023	1-101-880-00	CERAMIC	47PF	5%	50V
C024	1-101-004-00	CERAMIC	0.01MF		50V
C025	1-101-006-21	CERAMIC	0.047MF		50V
C026	1-101-006-21	CERAMIC	0.047MF		50V
C027	1-123-608-00	ELECT	0.22MF	20%	50V
C028	1-123-356-00	ELECT	10MF	20%	16V
C029	1-123-356-00	ELECT	10MF	20%	16V
C030	1-102-820-00	CERAMIC	330PF	5%	50V
C031	1-102-973-00	CERAMIC	100PF	5%	50V
C032	1-102-820-00	CERAMIC	330PF	5%	50V
C033	1-102-942-00	CERAMIC	5PF	0.5PF	50V
C034	1-102-958-00	CERAMIC	20PF	5%	50V
C035	1-102-959-00	CERAMIC	22PF	5%	50V
C038	1-101-006-21	CERAMIC	0.047MF		50V
C039	1-102-947-00	CERAMIC	10PF	5%	50V
C040	1-101-880-00	CERAMIC	47PF	5%	50V
C041	1-102-976-00	CERAMIC	180PF	5%	50V
C042	1-123-369-00	ELECT	4.7MF	20%	25V
C045	1-123-382-00	ELECT	3.3MF	20%	50V
C046	1-101-880-00	CERAMIC	47PF	5%	50V
C049	1-101-006-21	CERAMIC	0.047MF		50V
C050	1-102-980-00	CERAMIC	270PF	5%	50V
C051	1-101-005-00	CERAMIC	0.022MF		50V
C052	1-101-005-00	CERAMIC	0.022MF		50V
C053	1-101-006-21	CERAMIC	0.047MF		50V
C054	1-123-356-00	ELECT	10MF	20%	16V

Ref.No	Part No.	Description			Remark
C055	1-102-965-00	CERAMIC	39PF	5%	50V
C056	1-102-946-00	CERAMIC	9PF	0.5PF	50V
C057	1-102-963-00	CERAMIC	33PF	5%	50V
C058	1-101-006-21	CERAMIC	0.047MF		50V
C059	1-102-976-00	CERAMIC	180PF	5%	50V
C060	1-101-888-00	CERAMIC	68PF	5%	50V
C061	1-161-025-00	CERAMIC	0.1MF	10%	25V
C063	1-101-361-00	CERAMIC	150PF	5%	50V
C064	1-102-976-00	CERAMIC	180PF	5%	50V
C065	1-102-971-00	CERAMIC	82PF	5%	50V
C066	1-102-946-00	CERAMIC	9PF	0.5PF	50V
C067	1-102-820-00	CERAMIC	330PF	5%	50V
C068	1-102-960-00	CERAMIC	24PF	5%	50V
C073	1-101-006-21	CERAMIC	0.047MF		50V
C075	1-102-946-00	CERAMIC	9PF	0.5PF	50V
C076	1-102-947-00	CERAMIC	10PF	5%	50V
C077	1-102-119-00	CERAMIC	0.0015MF	10%	50V
C080	1-102-961-00	CERAMIC	27PF	5%	50V
C100	1-101-006-21	CERAMIC	0.047MF		50V
C101	1-102-074-00	CERAMIC	0.001MF	10%	50V
C102	1-101-004-00	CERAMIC	0.01MF		50V
C103	1-101-884-00	CERAMIC	56PF	5%	50V
C104	1-102-959-00	CERAMIC	22PF	5%	50V
C105	1-123-381-00	ELECT	2.2MF	20%	50V
C106	1-123-369-00	ELECT	4.7MF	20%	25V
C107	1-101-884-00	CERAMIC	56PF	5%	50V
C109	1-101-006-21	CERAMIC	0.047MF		50V
C110	1-123-381-00	ELECT	2.2MF	20%	50V
C111	1-123-369-00	ELECT	4.7MF	20%	25V
C112	1-123-369-00	ELECT	4.7MF	20%	25V
C114	1-101-880-00	CERAMIC	47PF	5%	50V
C115	1-101-888-00	CERAMIC	68PF	5%	50V
C116	1-101-361-00	CERAMIC	150PF	5%	50V
C117	1-102-947-00	CERAMIC	10PF	5%	50V
C118	1-123-307-00	ELECT	100MF	20%	6.3V
C119	1-101-890-21	CERAMIC	75PF	5%	50V
C120	1-101-886-21	CERAMIC	62PF	5%	50V
C121	1-101-004-00	CERAMIC	0.01MF		50V
C122	1-101-884-00	CERAMIC	56PF	5%	50V
C123	1-101-004-00	CERAMIC	0.01MF		50V
C124	1-102-959-00	CERAMIC	22PF	5%	50V
C125	1-123-356-00	ELECT	10MF	20%	16V
C126	1-102-074-00	CERAMIC	0.001MF	10%	50V
C127	1-102-074-00	CERAMIC	0.001MF	10%	50V
C128	1-101-006-21	CERAMIC	0.047MF		50V
C129	1-123-308-00	ELECT	220MF	20%	6.3V
C130	1-101-006-21	CERAMIC	0.047MF		50V
C131	1-101-006-21	CERAMIC	0.047MF		50V
C132	1-123-330-00	ELECT	22MF	20%	16V
C133	1-101-004-00	CERAMIC	0.01MF		50V
C135	1-102-074-00	CERAMIC	0.001MF	10%	50V
C136	1-102-959-00	CERAMIC	22PF	5%	50V
C137	1-102-074-00	CERAMIC	0.001MF	10%	50V

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Ref.No	Part No.	Description			Remark
C139	1-102-074-00	CERAMIC	0.001MF	10%	50V
C140	1-102-127-21	CERAMIC	0.0068MF	10%	50V
C141	1-123-382-00	ELECT	3.3MF	20%	50V
C142	1-102-074-00	CERAMIC	0.001MF	10%	50V
C143	1-102-074-00	CERAMIC	0.001MF	10%	50V
C144	1-101-006-21	CERAMIC	0.047MF		50V
C145	1-123-356-00	ELECT	10MF	20%	16V
C146	1-102-815-00	CERAMIC	110PF	5%	50V
C147	1-101-004-00	CERAMIC	0.01MF		50V
C148	1-102-074-00	CERAMIC	0.001MF	10%	50V
C150	1-102-074-00	CERAMIC	0.001MF	10%	50V
C151	1-101-361-00	CERAMIC	150PF	5%	50V
C152	1-102-824-00	CERAMIC	470PF	5%	50V
C153	1-102-959-00	CERAMIC	22PF	5%	50V
C154	1-123-381-00	ELECT	2.2MF	20%	50V
C155	1-101-006-21	CERAMIC	0.047MF		50V
C156	1-101-888-00	CERAMIC	68PF	5%	50V
C157	1-101-006-21	CERAMIC	0.047MF		50V
C158	1-102-123-00	CERAMIC	0.0033MF	10%	50V
C159	1-124-239-00	ELECT	6.8MF	20%	25V
C160	1-123-330-00	ELECT	22MF	20%	16V
C161	1-102-963-00	CERAMIC	33PF	5%	50V
C162	1-101-884-00	CERAMIC	56PF	5%	50V
C163	1-102-978-00	CERAMIC	220PF	5%	50V
C164	1-102-978-00	CERAMIC	220PF	5%	50V
C172	1-101-880-00	CERAMIC	47PF	5%	50V
C200	1-101-006-21	CERAMIC	0.047MF		50V
C201	1-101-006-21	CERAMIC	0.047MF		50V
C202	1-101-004-00	CERAMIC	0.01MF		50V
C203	1-101-004-00	CERAMIC	0.01MF		50V
C204	1-101-004-00	CERAMIC	0.01MF		50V
C206	1-101-004-00	CERAMIC	0.01MF		50V
C207	1-102-074-00	CERAMIC	0.001MF	10%	50V
C208	1-102-942-00	CERAMIC	5PF	0.5PF	50V
C209	1-123-356-00	ELECT	10MF	20%	16V
C210	1-101-004-00	CERAMIC	0.01MF		50V
C211	1-102-820-00	CERAMIC	330PF	5%	50V
C212	1-101-004-00	CERAMIC	0.01MF		50V
C213	1-102-820-00	CERAMIC	330PF	5%	50V
C214	1-101-006-21	CERAMIC	0.047MF		50V
C215	1-102-820-00	CERAMIC	330PF	5%	50V
C216	1-102-947-00	CERAMIC	10PF	5%	50V
C217	1-102-966-00	CERAMIC	43PF	5%	50V
C218	1-102-074-00	CERAMIC	0.001MF	10%	50V
C219	1-102-820-00	CERAMIC	330PF	5%	50V
C220	1-102-820-00	CERAMIC	330PF	5%	50V
C221	1-101-004-00	CERAMIC	0.01MF		50V
C222	1-124-239-00	ELECT	6.8MF	20%	25V
C223	1-101-005-00	CERAMIC	0.022MF		50V
C224	1-123-369-00	ELECT	4.7MF	20%	25V
C225	1-123-356-00	ELECT	10MF	20%	16V
C227	1-101-004-00	CERAMIC	0.01MF		50V
C228	1-101-006-21	CERAMIC	0.047MF		50V

Ref.No	Part No.	Description			Remark
C229	1-123-381-00	ELECT	2.2MF	20%	50V
C230	1-123-608-00	ELECT	0.22MF	20%	50V
C231	1-101-005-00	CERAMIC	0.022MF		50V
C232	1-102-074-00	CERAMIC	0.001MF	10%	50V
C233	1-101-006-21	CERAMIC	0.047MF		50V
C234	1-123-381-00	ELECT	2.2MF	20%	50V
C235	1-102-118-00	CERAMIC	0.0012MF	10%	50V
C237	1-101-880-00	CERAMIC	47PF	5%	50V
C238	1-102-820-00	CERAMIC	330PF	5%	50V
C239	1-102-074-00	CERAMIC	0.001MF	10%	50V
C240	1-123-381-00	ELECT	2.2MF	20%	50V
C241	1-102-074-00	CERAMIC	0.001MF	10%	50V
C242	1-101-005-00	CERAMIC	0.022MF		50V
C243	1-102-962-21	CERAMIC	30PF	5%	50V
C244	1-102-976-00	CERAMIC	180PF	5%	50V
C245	1-102-118-00	CERAMIC	0.0012MF	10%	50V
C246	1-102-121-00	CERAMIC	0.0022MF	10%	50V
C247	1-123-356-00	ELECT	10MF	20%	16V
C248	1-101-006-21	CERAMIC	0.047MF		50V
C249	1-102-820-00	CERAMIC	330PF	5%	50V
C250	1-123-607-00	ELECT	0.1MF	20%	50V
C251	1-123-609-00	ELECT	0.33MF	20%	50V
C252	1-102-963-00	CERAMIC	33PF	5%	50V
C253	1-102-973-00	CERAMIC	100PF	5%	50V
C254	1-101-880-00	CERAMIC	47PF	5%	50V
C255	1-101-880-00	CERAMIC	47PF	5%	50V
C256	1-123-356-00	ELECT	10MF	20%	16V
C257	1-161-025-00	CERAMIC	0.1MF	10%	25V
C258	1-101-888-00	CERAMIC	68PF	5%	50V
C259	1-102-951-00	CERAMIC	15PF	5%	50V
C260	1-102-976-00	CERAMIC	180PF	5%	50V
C261	1-102-945-00	CERAMIC	8PF	0.5PF	50V
C262	1-101-006-21	CERAMIC	0.047MF		50V
C264	1-101-006-21	CERAMIC	0.047MF		50V
C265	1-101-004-00	CERAMIC	0.01MF		50V
C266	1-101-006-21	CERAMIC	0.047MF		50V
C267	1-101-006-21	CERAMIC	0.047MF		50V
C269	1-101-004-00	CERAMIC	0.01MF		50V
C270	1-102-074-00	CERAMIC	0.001MF	10%	50V
C271	1-101-004-00	CERAMIC	0.01MF		50V
C300	1-123-607-00	ELECT	0.1MF	20%	50V
C301	1-102-973-00	CERAMIC	100PF	5%	50V
C302	1-123-607-00	ELECT	0.1MF	20%	50V
C303	1-102-973-00	CERAMIC	100PF	5%	50V
C304	1-123-381-00	ELECT	2.2MF	20%	50V
C305	1-123-380-00	ELECT	1MF	20%	50V
C400	1-101-004-00	CERAMIC	0.01MF		50V
C401	1-102-361-00	CERAMIC	0.0039MF	10%	50V
C501	1-101-361-00	CERAMIC	150PF	5%	50V
C502	1-101-004-00	CERAMIC	0.01MF		50V

CONNECTOR

CN002	*1-560-890-00	PIN, CONNECTOR 2P			

When indicating parts by reference number, please include the board name.

Ref.No	Part No.	Description	Remark
CN003	*1-560-895-00	PIN, CONNECTOR 7P	
CN004	*1-560-890-00	PIN, CONNECTOR 2P	
CN006	1-561-534-00	SOCKET 21P	
CN008	*1-560-893-00	PIN, CONNECTOR 5P	
CN011	*1-560-896-00	PIN, CONNECTOR 8P	
CN012	*1-560-893-00	PIN, CONNECTOR 5P	
		COMPOSITION CIRCUIT BLOCK	
CP001	1-232-919-11	COMPOSITION CIRCUIT BLOCK	
CP003	1-232-914-11	COMPOSITION CIRCUIT BLOCK	
CP004	1-232-917-11	COMPOSITION CIRCUIT BLOCK	
CP005	1-232-918-11	COMPOSITION CIRCUIT BLOCK	
CP006	1-232-928-11	COMPOSITION CIRCUIT BLOCK	
CP007	1-232-935-11	COMPOSITION CIRCUIT BLOCK	
CP008	1-232-937-11	COMPOSITION CIRCUIT BLOCK	
CP011	1-232-922-11	COMPOSITION CIRCUIT BLOCK	
CP012	1-232-920-11	COMPOSITION CIRCUIT BLOCK	
CP013	1-232-938-11	COMPOSITION CIRCUIT BLOCK	
CP014	1-232-915-11	COMPOSITION CIRCUIT BLOCK	
CP015	1-232-912-11	COMPOSITION CIRCUIT BLOCK	
CP016	1-232-931-11	COMPOSITION CIRCUIT BLOCK	
CP017	1-232-913-11	COMPOSITION CIRCUIT BLOCK	
CP018	1-232-933-11	COMPOSITION CIRCUIT BLOCK	
CP019	1-232-916-11	COMPOSITION CIRCUIT BLOCK	
CP020	1-232-932-11	COMPOSITION CIRCUIT BLOCK	
CP021	1-232-936-11	COMPOSITION CIRCUIT BLOCK	
CP022	1-232-934-11	COMPOSITION CIRCUIT BLOCK	
CP100	1-232-927-11	COMPOSITION CIRCUIT BLOCK	
CP101	1-232-921-11	COMPOSITION CIRCUIT BLOCK	
		TRIMMER	
CV200	1-141-227-00	CAP, CERAMIC TRIMMER	
		DIODE	
D001	8-719-911-19	DIODE 1SS119	
D002	8-719-151-07	DIODE RD5.1E-B	
D003	8-719-815-87	DIODE 1S1587	
D004	8-719-815-87	DIODE 1S1587	
D005	8-719-815-87	DIODE 1S1587	
D006	8-719-815-87	DIODE 1S1587	
D008	8-719-911-19	DIODE 1SS119	
D009	8-719-911-19	DIODE 1SS119	
D010	8-719-815-87	DIODE 1S1587	
D102	8-719-000-12	DIODE MC931	
D103	8-719-000-06	DIODE MC921	
D104	8-719-815-87	DIODE 1S1587	
D105	8-719-815-87	DIODE 1S1587	
D106	8-719-000-12	DIODE MC931	
D107	8-719-000-12	DIODE MC931	
D200	8-719-100-37	DIODE RD6.2EB1	
D203	8-719-000-06	DIODE MC921	
D204	8-719-000-06	DIODE MC921	

Ref.No	Part No.	Description	Remark
		DELAY LINE	
DL100	1-415-282-31	DELAY LINE	
DL101	1-415-386-21	DELAY LINE, 1H (13.3MHZ)	
		FILTER	
FL002	1-409-397-11	TRAP	
FL100	1-235-440-11	FILTER, BAND PASS (3.7MHZ)	
FL101	1-235-441-11	FILTER, BAND PASS (5.17MHZ)	
FL200	1-409-408-11	C.E TRAP	
FL201	1-409-396-11	REC C TRAP	
FL202	1-235-437-11	BPF, PB C	
		IC	
IC001	8-752-013-00	IC CX20130	
IC002	8-752-013-10	IC CX20131	
IC003	8-752-013-20	IC CX20132	
IC004	8-752-203-10	IC CX22031	
IC005	8-759-913-64	IC CX23064	
IC006	8-759-202-68	IC CX20147	
IC007	1-235-497-11	REC PILOT LPF	
IC008	8-759-700-40	IC NJM4560S	
		COIL	
L001	1-408-421-00	MICRO INDUCTOR 100UH	
L002	1-408-413-00	MICRO INDUCTOR 22UH	
L004	1-408-424-00	MICRO INDUCTOR 180UH	
L005	1-408-426-00	MICRO INDUCTOR 270UH	
L006	1-408-425-00	MICRO INDUCTOR 220UH	
L007	1-408-419-00	MICRO INDUCTOR 68UH	
L010	1-408-424-00	MICRO INDUCTOR 180UH	
L012	1-408-412-00	MICRO INDUCTOR 18UH	
L013	1-408-421-00	MICRO INDUCTOR 100UH	
L014	1-408-422-00	MICRO INDUCTOR 120UH	
L016	1-408-416-00	MICRO INDUCTOR 39UH	
L017	1-408-427-00	MICRO INDUCTOR 330UH	
L018	1-408-422-00	MICRO INDUCTOR 120UH	
L019	1-408-423-00	MICRO INDUCTOR 150UH	
L021	1-410-072-21	MICRO INDUCTOR 820UH	
L022	1-408-421-00	MICRO INDUCTOR 100UH	
L100	1-408-397-00	MICRO INDUCTOR 1UH	
L101	1-408-397-00	MICRO INDUCTOR 1UH	
L103	1-408-418-00	MICRO INDUCTOR 56UH	
L104	1-408-420-00	MICRO INDUCTOR 82UH	
L105	1-408-418-00	MICRO INDUCTOR 56UH	
L106	1-408-421-00	MICRO INDUCTOR 100UH	
L107	1-408-419-00	MICRO INDUCTOR 68UH	
L108	1-408-413-00	MICRO INDUCTOR 22UH	
L109	1-408-408-00	MICRO INDUCTOR 8.2UH	
L110	1-408-412-00	MICRO INDUCTOR 18UH	
L111	1-408-413-00	MICRO INDUCTOR 22UH	
L112	1-408-418-00	MICRO INDUCTOR 56UH	
L113	1-408-397-00	MICRO INDUCTOR 1UH	

When indicating parts by reference number, please include the board name.

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Ref.No	Part No.	Description	Remark
L114	1-408-417-00	MICRO INDUCTOR 47UH	
L115	1-408-417-00	MICRO INDUCTOR 47UH	
L116	1-408-414-00	MICRO INDUCTOR 27UH	
L200	1-408-424-00	MICRO INDUCTOR 180UH	
L201	1-408-413-00	MICRO INDUCTOR 22UH	
L203	1-408-422-00	MICRO INDUCTOR 120UH	
L204	1-410-072-21	MICRO INDUCTOR 820UH	
L205	1-408-422-00	MICRO INDUCTOR 120UH	
L206	1-408-425-00	MICRO INDUCTOR 220UH	
L207	1-408-420-00	MICRO INDUCTOR 82UH	
L208	1-408-407-00	MICRO INDUCTOR 6.8UH	
L209	1-408-427-00	MICRO INDUCTOR 330UH	
L400	1-407-177-XX	MICRO INDUCTOR 470UH	
		VARIABLE COIL	
LV100	1-408-512-00	COIL (VARIABLE)	
		IC LINK	
PS200 ⚠	1-532-679-00	LINK, IC	
		TRANSISTOR	
Q002	8-729-900-36	TRANSISTOR DTC124ES	
Q003	8-729-117-54	TRANSISTOR 2SA1175	
Q004	8-729-117-54	TRANSISTOR 2SA1175	
Q007	8-729-117-54	TRANSISTOR 2SA1175	
Q008	8-729-384-48	TRANSISTOR 2SA844	
Q009	8-729-245-83	TRANSISTOR 2SC2458	
Q010	8-729-245-83	TRANSISTOR 2SC2458	
Q011	8-729-900-36	TRANSISTOR DTC124ES	
Q012	8-729-117-54	TRANSISTOR 2SA1175	
Q013	8-729-117-54	TRANSISTOR 2SA1175	
Q014	8-729-900-36	TRANSISTOR DTC124ES	
Q015	8-729-900-36	TRANSISTOR DTC124ES	
Q016	8-729-245-83	TRANSISTOR 2SC2458	
Q017	8-729-900-36	TRANSISTOR DTC124ES	
Q021	8-729-900-89	TRANSISTOR DTC144ES	
Q100	8-729-900-36	TRANSISTOR DTC124ES	
Q101	8-729-900-36	TRANSISTOR DTC124ES	
Q102	8-729-117-54	TRANSISTOR 2SA1175	
Q103	8-729-245-83	TRANSISTOR 2SC2458	
Q104	8-729-245-83	TRANSISTOR 2SC2458	
Q105	8-729-245-83	TRANSISTOR 2SC2458	
Q106	8-729-245-83	TRANSISTOR 2SC2458	
Q107	8-729-900-36	TRANSISTOR DTC124ES	
Q108	8-729-900-36	TRANSISTOR DTC124ES	
Q109	8-729-900-36	TRANSISTOR DTC124ES	
Q110	8-729-178-54	TRANSISTOR 2SC2785	
Q200	8-729-245-83	TRANSISTOR 2SC2458	
Q201	8-729-900-36	TRANSISTOR DTC124ES	
Q203	8-729-603-50	TRANSISTOR 2SC403SP	
Q204	8-729-603-50	TRANSISTOR 2SC403SP	
Q205	8-729-900-36	TRANSISTOR DTC124ES	

Ref.No	Part No.	Description				Remark
Q206	8-729-117-54	TRANSISTOR 2SA1175				
Q207	8-729-900-36	TRANSISTOR DTC124ES				
Q208	8-729-245-83	TRANSISTOR 2SC2458				
Q209	8-729-245-83	TRANSISTOR 2SC2458				
Q212	8-729-245-83	TRANSISTOR 2SC2458				
Q213	8-729-900-36	TRANSISTOR DTC124ES				
Q214	8-729-900-36	TRANSISTOR DTC124ES				
Q215	8-729-245-83	TRANSISTOR 2SC2458				
Q216	8-729-245-83	TRANSISTOR 2SC2458				
Q217	8-729-245-83	TRANSISTOR 2SC2458				
Q218	8-729-900-61	TRANSISTOR DTA114ES				
Q220	8-729-178-54	TRANSISTOR 2SC2785				
Q258	8-729-900-36	TRANSISTOR DTC124ES				
Q300	8-729-900-36	TRANSISTOR DTC124ES				
		RESISTOR				
R001	1-247-881-00	CARBON	120K	5%	1/6W	
R002	1-247-895-00	CARBON	470K	5%	1/6W	
R003	1-247-857-00	CARBON	12K	5%	1/6W	
R004	1-247-859-00	CARBON	15K	5%	1/6W	
R005	1-249-437-11	CARBON	47K	5%	1/6W	
R006	1-249-437-11	CARBON	47K	5%	1/6W	
R007	1-247-831-00	CARBON	1K	5%	1/6W	
R008	1-247-891-00	CARBON	330K	5%	1/6W	
R010	1-247-831-00	CARBON	1K	5%	1/6W	
R011	1-247-879-00	CARBON	100K	5%	1/6W	
R012	1-247-875-00	CARBON	68K	5%	1/6W	
R013	1-247-831-00	CARBON	1K	5%	1/6W	
R014	1-249-437-11	CARBON	47K	5%	1/6W	
R015	1-249-437-11	CARBON	47K	5%	1/6W	
R016	1-249-437-11	CARBON	47K	5%	1/6W	
R017	1-247-873-00	CARBON	56K	5%	1/6W	
R018	1-249-425-11	CARBON	4.7K	5%	1/6W	
R019	1-249-425-11	CARBON	4.7K	5%	1/6W	
R020	1-247-831-00	CARBON	1K	5%	1/6W	
R022	1-247-863-00	CARBON	22K	5%	1/6W	
R023	1-247-823-00	CARBON	470	5%	1/6W	
R024	1-249-437-11	CARBON	47K	5%	1/6W	
R025	1-249-437-11	CARBON	47K	5%	1/6W	
R026	1-249-437-11	CARBON	47K	5%	1/6W	
R027	1-249-437-11	CARBON	47K	5%	1/6W	
R029	1-247-839-00	CARBON	2.2K	5%	1/6W	
R030	1-247-841-00	CARBON	2.7K	5%	1/6W	
R031	1-247-839-00	CARBON	2.2K	5%	1/6W	
R032	1-247-845-00	CARBON	3.9K	5%	1/6W	
R033	1-247-883-00	CARBON	150K	5%	1/6W	
R037	1-247-853-00	CARBON	8.2K	5%	1/6W	
R040	1-247-823-00	CARBON	470	5%	1/6W	
R042	1-247-831-00	CARBON	1K	5%	1/6W	
R043	1-247-863-00	CARBON	22K	5%	1/6W	
R045	1-247-831-00	CARBON	1K	5%	1/6W	
R050	1-247-839-00	CARBON	2.2K	5%	1/6W	
R051	1-247-839-00	CARBON	2.2K	5%	1/6W	

The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

Ref.No	Part No.	Description				Remark
R052	1-247-841-00	CARBON	2.7K	5%	1/6W	
R054	1-247-837-00	CARBON	1.8K	5%	1/6W	
R055	1-247-804-00	CARBON	75	5%	1/6W	
R056	1-247-797-00	CARBON	39	5%	1/6W	
R057	1-247-797-00	CARBON	39	5%	1/6W	
R058	1-247-825-00	CARBON	560	5%	1/6W	
R059	1-247-845-00	CARBON	3.9K	5%	1/6W	
R060	1-247-821-00	CARBON	390	5%	1/6W	
R062	1-247-825-00	CARBON	560	5%	1/6W	
R063	1-247-817-00	CARBON	270	5%	1/6W	
R064	1-247-863-00	CARBON	22K	5%	1/6W	
R065	1-247-823-00	CARBON	470	5%	1/6W	
R066	1-247-833-00	CARBON	1.2K	5%	1/6W	
R067	1-247-805-00	CARBON	82	5%	1/6W	
R068	1-247-839-00	CARBON	2.2K	5%	1/6W	
R069	1-247-827-00	CARBON	680	5%	1/6W	
R070	1-247-883-00	CARBON	150K	5%	1/6W	
R072	1-247-815-00	CARBON	220	5%	1/6W	
R073	1-249-425-11	CARBON	4.7K	5%	1/6W	
R074	1-249-425-11	CARBON	4.7K	5%	1/6W	
R075	1-247-843-00	CARBON	3.3K	5%	1/6W	
R077	1-247-825-00	CARBON	560	5%	1/6W	
R079	1-249-419-11	CARBON	1.5K	5%	1/6W	
R080	1-247-863-00	CARBON	22K	5%	1/6W	
R083	1-247-817-00	CARBON	270	5%	1/6W	
R084	1-247-815-00	CARBON	220	5%	1/6W	
R101	1-247-809-00	CARBON	120	5%	1/6W	
R102	1-247-857-00	CARBON	12K	5%	1/6W	
R103	1-247-863-00	CARBON	22K	5%	1/6W	
R104	1-247-863-00	CARBON	22K	5%	1/6W	
R105	1-247-895-00	CARBON	470K	5%	1/6W	
R106	1-247-903-00	CARBON	1M	5%	1/6W	
R107	1-247-807-00	CARBON	100	5%	1/6W	
R108	1-249-429-11	CARBON	10K	5%	1/6W	
R110	1-247-869-00	CARBON	39K	5%	1/6W	
R111	1-247-859-00	CARBON	15K	5%	1/6W	
R113	1-247-833-00	CARBON	1.2K	5%	1/6W	
R114	1-249-425-11	CARBON	4.7K	5%	1/6W	
R122	1-247-829-00	CARBON	820	5%	1/6W	
R125	1-247-833-00	CARBON	1.2K	5%	1/6W	
R131	1-247-831-00	CARBON	1K	5%	1/6W	
R132	1-247-823-00	CARBON	470	5%	1/6W	
R133	1-247-831-00	CARBON	1K	5%	1/6W	
R134	1-247-821-00	CARBON	390	5%	1/6W	
R135	1-247-821-00	CARBON	390	5%	1/6W	
R136	1-247-809-00	CARBON	120	5%	1/6W	
R137	1-247-817-00	CARBON	270	5%	1/6W	
R138	1-249-437-11	CARBON	47K	5%	1/6W	
R139	1-249-437-11	CARBON	47K	5%	1/6W	
R140	1-247-831-00	CARBON	1K	5%	1/6W	
R141	1-247-849-00	CARBON	5.6K	5%	1/6W	
R142	1-247-859-00	CARBON	15K	5%	1/6W	
R143	1-247-807-00	CARBON	100	5%	1/6W	

Ref.No	Part No.	Description				Remark
R144	1-247-791-00	CARBON	22	5%	1/6W	
R145	1-247-839-00	CARBON	2.2K	5%	1/6W	
R146	1-247-831-00	CARBON	1K	5%	1/6W	
R147	1-247-831-00	CARBON	1K	5%	1/6W	
R151	1-249-419-11	CARBON	1.5K	5%	1/6W	
R155	1-249-437-11	CARBON	47K	5%	1/6W	
R156	1-247-875-00	CARBON	68K	5%	1/6W	
R159	1-247-825-00	CARBON	560	5%	1/6W	
R161	1-247-823-00	CARBON	470	5%	1/6W	
R164	1-247-827-00	CARBON	680	5%	1/6W	
R165	1-249-425-11	CARBON	4.7K	5%	1/6W	
R168	1-249-425-11	CARBON	4.7K	5%	1/6W	
R173	1-249-419-11	CARBON	1.5K	5%	1/6W	
R174	1-247-849-00	CARBON	5.6K	5%	1/6W	
R175	1-247-827-00	CARBON	680	5%	1/6W	
R176	1-247-827-00	CARBON	680	5%	1/6W	
R178	1-247-831-00	CARBON	1K	5%	1/6W	
R179	1-247-895-00	CARBON	470K	5%	1/6W	
R180	1-249-434-11	CARBON	27K	5%	1/6W	
R181	1-247-831-00	CARBON	1K	5%	1/6W	
R182	1-249-429-11	CARBON	10K	5%	1/6W	
R183	1-247-861-00	CARBON	18K	5%	1/6W	
R184	1-247-879-00	CARBON	100K	5%	1/6W	
R185	1-247-841-00	CARBON	2.7K	5%	1/6W	
R186	1-247-859-00	CARBON	15K	5%	1/6W	
R187	1-247-867-00	CARBON	33K	5%	1/6W	
R190	1-249-432-11	CARBON	18K	5%	1/6W	
R200	1-247-867-00	CARBON	33K	5%	1/6W	
R201	1-247-823-00	CARBON	470	5%	1/6W	
R203	1-247-841-00	CARBON	2.7K	5%	1/6W	
R209	1-247-831-00	CARBON	1K	5%	1/6W	
R218	1-247-807-00	CARBON	100	5%	1/6W	
R219	1-247-839-00	CARBON	2.2K	5%	1/6W	
R220	1-247-831-00	CARBON	1K	5%	1/6W	
R221	1-247-831-00	CARBON	1K	5%	1/6W	
R222	1-247-859-00	CARBON	15K	5%	1/6W	
R223	1-247-827-00	CARBON	680	5%	1/6W	
R224	1-247-859-00	CARBON	15K	5%	1/6W	
R225	1-249-425-11	CARBON	4.7K	5%	1/6W	
R226	1-247-863-00	CARBON	22K	5%	1/6W	
R227	1-247-839-00	CARBON	2.2K	5%	1/6W	
R232	1-247-863-00	CARBON	22K	5%	1/6W	
R233	1-247-879-00	CARBON	100K	5%	1/6W	
R234	1-247-851-00	CARBON	6.8K	5%	1/6W	
R235	1-247-839-00	CARBON	2.2K	5%	1/6W	
R236	1-249-437-11	CARBON	47K	5%	1/6W	
R237	1-249-437-11	CARBON	47K	5%	1/6W	
R238	1-249-425-11	CARBON	4.7K	5%	1/6W	
R239	1-247-831-00	CARBON	1K	5%	1/6W	
R240	1-249-425-11	CARBON	4.7K	5%	1/6W	
R248	1-247-885-00	CARBON	180K	5%	1/6W	
R251	1-249-429-11	CARBON	10K	5%	1/6W	
R253	1-249-425-11	CARBON	4.7K	5%	1/6W	

When indicating parts by reference number, please include the board name.

Ref.No	Part No.	Description				Remark
R254	1-249-437-11	CARBON	47K	5%	1/6W	
R261	1-247-831-00	CARBON	1K	5%	1/6W	
R262	1-247-841-00	CARBON	2.7K	5%	1/6W	
R264	1-247-831-00	CARBON	1K	5%	1/6W	
R265	1-247-823-00	CARBON	470	5%	1/6W	
R266	1-247-807-00	CARBON	100	5%	1/6W	
R267	1-247-827-00	CARBON	680	5%	1/6W	
R268	1-247-867-00	CARBON	33K	5%	1/6W	
R269	1-247-863-00	CARBON	22K	5%	1/6W	
R270	1-247-831-00	CARBON	1K	5%	1/6W	
R271	1-249-425-11	CARBON	4.7K	5%	1/6W	
R272	1-247-849-00	CARBON	5.6K	5%	1/6W	
R273	1-247-867-00	CARBON	33K	5%	1/6W	
R274	1-249-425-11	CARBON	4.7K	5%	1/6W	
R277	1-249-437-11	CARBON	47K	5%	1/6W	
R280	1-247-829-00	CARBON	820	5%	1/6W	
R282	1-247-863-00	CARBON	22K	5%	1/6W	
R284	1-247-831-00	CARBON	1K	5%	1/6W	
R285	1-247-841-00	CARBON	2.7K	5%	1/6W	
R286	1-247-815-00	CARBON	220	5%	1/6W	
R287	1-247-831-00	CARBON	1K	5%	1/6W	
R288	1-247-831-00	CARBON	1K	5%	1/6W	
R289	1-247-831-00	CARBON	1K	5%	1/6W	
R290	1-247-840-00	CARBON	2.4K	5%	1/6W	
R292	1-249-425-11	CARBON	4.7K	5%	1/6W	
R293	1-247-831-00	CARBON	1K	5%	1/6W	
R300	1-247-887-00	CARBON	220K	5%	1/6W	
R301	1-249-437-11	CARBON	47K	5%	1/6W	
R302	1-249-437-11	CARBON	47K	5%	1/6W	
R303	1-247-887-00	CARBON	220K	5%	1/6W	
R304	1-249-437-11	CARBON	47K	5%	1/6W	
R305	1-249-437-11	CARBON	47K	5%	1/6W	
R306	1-247-827-00	CARBON	680	5%	1/6W	
R307	1-247-827-00	CARBON	680	5%	1/6W	
R309	1-247-783-00	CARBON	10	5%	1/6W	
R310	1-247-831-00	CARBON	1K	5%	1/6W	
R311	⚠ 1-247-831-00	CARBON	1K	5%	1/6W	
R312	1-247-873-00	CARBON	56K	5%	1/6W	
R400	1-247-831-00	CARBON	1K	5%	1/6W	
R401	1-249-419-11	CARBON	1.5K	5%	1/6W	
R402	1-249-429-11	CARBON	10K	5%	1/6W	
R403	1-247-803-00	CARBON	68	5%	1/6W	
R501	1-247-831-00	CARBON	1K	5%	1/6W	
R900	1-249-419-11	CARBON	1.5K	5%	1/6W	

VARIABLE RESISTOR

Ref.No	Part No.	Description	Remark
RV001	1-228-995-00	RES, ADJ, CARBON 22K	
RV002	1-228-993-00	RES, ADJ, CARBON 4.7K	
RV003	1-228-995-00	RES, ADJ, CARBON 22K	
RV004	1-228-994-00	RES, ADJ, CARBON 10K	
RV005	1-228-995-00	RES, ADJ, CARBON 22K	
RV006	1-228-995-00	RES, ADJ, CARBON 22K	
RV100	1-228-995-00	RES, ADJ, CARBON 22K	
RV101	1-228-996-00	RES, ADJ, CARBON 47K	
RV102	1-228-998-00	RES, ADJ, CARBON 220K	
RV103	1-228-997-00	RES, ADJ, CARBON 100K	
RV201	1-228-745-00	RES, ADJ, CARBON 1K	
RV202	1-228-995-00	RES, ADJ, CARBON 22K	
RV203	1-228-989-00	RES, ADJ, CARBON 470	
RV204	1-228-994-00	RES, ADJ, CARBON 10K	
RV205	1-228-994-00	RES, ADJ, CARBON 10K	
RV206	1-228-995-00	RES, ADJ, CARBON 22K	

CRYSTAL

Ref.No	Part No.	Description
X100	1-567-442-11	VIBRATOR, CRYSTAL
X200	1-567-146-11	VIBRATOR, CRYSTAL
X201	1-567-345-11	VIBRATOR, CRYSTAL

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*1-617-208-11 SK-9 BOARD (AEP/UK/Australian Model)
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CAPACITOR

Ref.No	Part No.	Description			
C601	1-161-025-00	CERAMIC	0.1MF	10%	25V
C602	1-161-023-00	CERAMIC	0.068MF	10%	25V

TRANSISTOR

Ref.No	Part No.	Description
Q111	8-729-900-36	TRANSISTOR DTC124ES
Q401	8-729-900-89	TRANSISTOR DTC144ES
Q402	8-729-178-54	TRANSISTOR 2SC2785

RESISTOR

Ref.No	Part No.	Description			
R600	1-247-831-00	CARBON	1K	5%	1/6W
R601	1-249-425-11	CARBON	4.7K	5%	1/6W

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*A-7060-316-A TA-28B BOARD, COMPLETE (Australian Model)
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⚠ 1-463-661-21 TUNER, ET (BT-886D)

CAPACITOP

Ref.No	Part No.	Description			
C001	1-102-531-00	CERAMIC	150PF	5%	50V
C002	1-102-530-00	CERAMIC	120PF	5%	50V
C003	1-102-513-00	CERAMIC	18PF	5%	50V
C004	1-102-518-00	CERAMIC	33PF	5%	50V
C005	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C006	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C007	1-123-307-00	ELECT	100MF	20%	10V
C008	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C009	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C010	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C011	1-123-379-00	ELECT	0.47MF	20%	50V
C012	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C013	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C014	1-102-125-00	CERAMIC	0.0047MF	10%	50V

The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

Ref.No	Part No.	Description			Remark
C015	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C016	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C017	1-123-318-00	ELECT	33MF	20%	16V
C018	1-102-529-00	CERAMIC	100PF	5%	50V
C019	1-102-937-00	CERAMIC	4PF	0.25PF	50V
C020	1-102-518-00	CERAMIC	33PF	5%	50V
C021	1-102-529-00	CERAMIC	100PF	5%	50V
C022	1-102-937-00	CERAMIC	4PF	0.25PF	50V
C023	1-102-518-00	CERAMIC	33PF	5%	50V
C024	1-102-106-00	CERAMIC	100PF	10%	50V
C025	1-123-307-00	ELECT	100MF	20%	10V
C026	1-102-108-00	CERAMIC	150PF	10%	50V
C027	1-123-369-00	ELECT	4.7MF	20%	25V
C028	1-123-379-00	ELECT	0.47MF	20%	50V
C029	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C030	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C031	1-123-286-00	ELECT	0.33MF	20%	50V
C032	1-102-108-00	CERAMIC	150PF	10%	50V
C033	1-130-014-00	FILM	470PF	5%	50V
C034	1-123-379-00	ELECT	0.47MF	20%	50V
C035	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C036	1-123-318-00	ELECT	33MF	20%	16V
C037	1-101-004-00	CERAMIC	0.01MF		50V
C038	1-101-004-00	CERAMIC	0.01MF		50V
C039	1-102-525-00	CERAMIC	68PF	5%	50V
C040	1-102-816-00	CERAMIC	120PF	5%	50V
C041	1-130-072-00	FILM	0.022MF	2%	100V
C042	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C043	1-106-184-00	MYLAR	0.0033MF	5%	50V
C044	1-106-184-00	MYLAR	0.0033MF	5%	50V
C045	1-123-356-00	ELECT	10MF	20%	16V
C046	1-123-306-00	ELECT	47MF	20%	10V
C047	1-123-306-00	ELECT	47MF	20%	10V
C048	1-106-184-00	MYLAR	0.0033MF	5%	50V
C049	1-106-184-00	MYLAR	0.0033MF	5%	50V
C050	1-123-379-00	ELECT	0.47MF	20%	50V
C051	1-123-332-00	ELECT	47MF	20%	16V
C052	1-101-004-00	CERAMIC	0.01MF		50V
C053	1-123-356-00	ELECT	10MF	20%	16V
C054	1-101-004-00	CERAMIC	0.01MF		50V
C055	1-101-004-00	CERAMIC	0.01MF		50V
C056	1-123-356-00	ELECT	10MF	20%	16V
C057	1-123-318-00	ELECT	33MF	20%	16V
C058	1-123-379-00	ELECT	0.47MF	20%	50V
C059	1-108-579-00	MYLAR	0.01MF	5%	50V
C060	1-108-579-00	MYLAR	0.01MF	5%	50V
C061	1-123-356-00	ELECT	10MF	20%	16V
C063	1-161-025-00	CERAMIC	0.1MF	10%	25V
C064	1-123-330-00	ELECT	22MF	20%	16V
C065	1-123-356-00	ELECT	10MF	20%	16V
C066	1-123-318-00	ELECT	33MF	20%	16V
C068	1-123-380-00	ELECT	1MF	20%	50V
C069	1-123-380-00	ELECT	1MF	20%	50V

Ref.No	Part No.	Description			Remark
C070	1-123-369-00	ELECT	4.7MF	20%	25V
C071	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C072	1-108-599-00	MYLAR	0.068MF	5%	50V
C073	1-108-599-00	MYLAR	0.068MF	5%	50V
C074	1-123-318-00	ELECT	33MF	20%	16V
C075	1-123-356-00	ELECT	10MF	20%	16V
C076	1-123-356-00	ELECT	10MF	20%	50V
C077	1-108-603-00	MYLAR	0.1MF	5%	50V
C078	1-102-106-00	CERAMIC	100PF	10%	50V
C079	1-123-318-00	ELECT	33MF	20%	16V
C080	1-123-332-00	ELECT	47MF	20%	16V
C081	1-108-603-00	MYLAR	0.1MF	5%	50V
C082	1-161-013-00	CERAMIC	0.01MF	10%	25V
C083	1-123-356-00	ELECT	10MF	20%	16V
C084	1-123-356-00	ELECT	10MF	20%	16V
C085	1-102-963-00	CERAMIC	33PF	5%	50V
C086	1-123-356-00	ELECT	10MF	20%	16V
C087	1-101-004-00	CERAMIC	0.01MF		50V
C088	1-108-579-00	MYLAR	0.01MF	5%	50V
C089	1-123-369-00	ELECT	4.7MF	20%	25V
C090	1-123-369-00	ELECT	4.7MF	20%	25V
C091	1-123-369-00	ELECT	4.7MF	20%	25V
C092	1-102-115-00	CERAMIC	560PF	10%	50V
C093	1-161-059-00	CERAMIC	0.047MF	10%	25V
C094	1-101-059-21	CERAMIC	510PF	5%	50V
C095	1-123-381-00	ELECT	2.2MF	20%	50V
C096	1-106-172-00	MYLAR	0.001MF	5%	50V
C097	1-102-113-00	CERAMIC	390PF	10%	50V
C098	1-106-172-00	MYLAR	0.001MF	5%	50V
C099	1-102-117-00	CERAMIC	820PF	10%	50V
C101	1-123-318-00	ELECT	33MF	20%	16V
C102	1-102-961-00	CERAMIC	27PF	5%	50V
C103	1-123-356-00	ELECT	10MF	20%	16V
C104	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C105	1-102-520-00	CERAMIC	39PF	5%	50V
C106	1-123-356-00	ELECT	10MF	20%	16V
C107	1-102-116-00	CERAMIC	680PF	10%	50V
C108	1-123-332-00	ELECT	47MF	20%	16V
C109	1-102-074-00	CERAMIC	0.001MF	10%	50V
C110	1-161-025-00	CERAMIC	0.1MF	10%	25V
C111	1-102-112-00	CERAMIC	330PF	10%	50V
C112	1-108-599-00	MYLAR	0.068MF	5%	50V
C113	1-106-186-00	MYLAR	0.0039MF	5%	50V
C114	1-123-318-00	ELECT	33MF	20%	16V
C115	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C116	1-102-125-00	CERAMIC	0.0047MF	10%	50V

DISCRIMINATOR

CD001	1-404-501-00	DISCRIMINATOR, CERAMIC

FILTER

CF001	1-527-840-00	FILTER, CERAMIC

When indicating parts by reference number, please include the board name.

TA-28B

Ref.No	Part No.	Description	Remark
CF002	1-527-839-00	FILTER, CERAMIC	
		CONNECTOR	
CN001	*1-560-890-00	PIN, CONNECTOR 2P	
CN007	*1-560-890-00	PIN, CONNECTOR 2P	
CN008	*1-560-890-00	PIN, CONNECTOR 2P	
CN009	*1-560-896-00	PIN, CONNECTOR 8P	
CN010	*1-560-893-00	PIN, CONNECTOR 5P	
		TRIMMER	
CT001	1-404-134-00	TRAP, CERAMIC (5.5MHZ)	
		DIODE	
D001	8-719-911-19	DIODE 1SS119	
D002	8-719-911-19	DIODE 1SS119	
D003	8-719-911-19	DIODE 1SS119	
D004	8-719-911-19	DIODE 1SS119	
D005	8-719-911-19	DIODE 1SS119	
D006	8-719-911-19	DIODE 1SS119	
D007	8-719-911-19	DIODE 1SS119	
D008	8-719-911-19	DIODE 1SS119	
D010	8-719-911-19	DIODE 1SS119	
D011	8-719-911-19	DIODE 1SS119	
D012	8-719-911-19	DIODE 1SS119	
D013	8-719-911-19	DIODE 1SS119	
D014	8-719-911-19	DIODE 1SS119	
D015	8-719-911-19	DIODE 1SS119	
		IC	
IC001	8-759-276-07	IC TA7607AP	
IC002	8-759-909-54	IC TDA2546A	
IC003	8-759-007-54	IC TDA4940	
IC004	8-759-007-55	IC TDA4944	
IC005	8-759-602-16	IC M54572L	
IC006	8-759-157-40	IC UPC574J	
IC007	8-759-729-03	IC NJM2903D	
IC008	8-759-040-46	IC MC14046BCP	
IC009	8-759-201-47	IC TA7357AP	
IC010	8-759-040-46	IC MC14046BCP	
		COIL	
L001	1-404-476-00	COIL, IF	
L002	1-404-476-00	COIL, IF	
L003	1-408-399-00	MICRO INDUCTOR 1.5UH	
L004	1-408-406-00	MICRO INDUCTOR 5.6UH	
L005	1-404-521-11	VIFT	
L006	1-404-521-11	VIFT	
L007	1-408-409-00	MICRO INDUCTOR 10UH	
L008	1-408-408-00	MICRO INDUCTOR 8.2UH	
L009	1-408-428-00	MICRO INDUCTOR 390UH	
L010	1-404-477-00	COIL, IF	
L011	1-408-406-00	MICRO INDUCTOR 5.6UH	
L012	1-404-493-00	COIL	

Ref.No	Part No.	Description	Remark
L014	1-408-429-00	MICRO INDUCTOR 470UH	
L015	1-408-406-00	MICRO INDUCTOR 5.6UH	
		TRANSISTOR	
Q001	8-729-105-47	TRANSISTOR 2SC2026	
Q002	8-729-117-52	TRANSISTOR 2SA1175	
Q003	8-729-245-83	TRANSISTOR 2SC2458	
Q004	8-729-245-83	TRANSISTOR 2SC2458	
Q005	8-729-900-89	TRANSISTOR DTC144ES	
Q006	8-729-900-89	TRANSISTOR DTC144ES	
Q007	8-729-900-89	TRANSISTOR DTC144ES	
Q008	8-729-900-36	TRANSISTOR DTC124ES	
Q009	8-729-900-36	TRANSISTOR DTC124ES	
Q010	8-729-245-83	TRANSISTOR 2SC2458	
Q011	8-729-245-83	TRANSISTOR 2SC2458	
Q012	8-729-245-83	TRANSISTOR 2SC2458	
Q013	8-729-245-83	TRANSISTOR 2SC2458	
Q014	8-729-245-83	TRANSISTOR 2SC2458	
Q015	8-729-245-83	TRANSISTOR 2SC2458	
Q016	8-729-245-83	TRANSISTOR 2SC2458	
Q017	8-729-603-30	TRANSISTOR 2SC403SP	
Q018	8-729-245-83	TRANSISTOR 2SC2458	
Q019	8-729-245-83	TRANSISTOR 2SC2458	
Q020	8-729-900-36	TRANSISTOR DTC124ES	
Q021	8-729-113-32	TRANSISTOR 2SB733	
Q022	8-729-900-89	TRANSISTOR DTC144ES	
Q023	8-729-117-54	TRANSISTOR 2SA1175	
Q024	8-729-245-83	TRANSISTOR 2SC2458	
Q025	8-729-245-83	TRANSISTOR 2SC2458	
Q026	8-729-117-52	TRANSISTOR 2SA1175	
Q027	8-729-900-89	TRANSISTOR DTC144ES	
Q028	8-729-900-89	TRANSISTOR DTC144ES	
Q029	8-729-900-89	TRANSISTOR DTC144ES	
Q030	8-729-900-89	TRANSISTOR DTC144ES	
		RESISTOR	
R001	1-249-425-11	CARBON 4.7K 5% 1/6W	
R002	1-247-825-00	CARBON 560 5% 1/6W	
R003	1-247-823-00	CARBON 470 5% 1/6W	
R004	1-249-425-11	CARBON 4.7K 5% 1/6W	
R005	1-247-815-00	CARBON 220 5% 1/6W	
R006	1-247-837-00	CARBON 1.8K 5% 1/6W	
R007	1-247-901-00	CARBON 820K 5% 1/6W	
R008	1-247-839-00	CARBON 2.2K 5% 1/6W	
R009	1-247-815-00	CARBON 220 5% 1/6W	
R010	1-247-831-00	CARBON 1K 5% 1/6W	
R011	1-247-833-00	CARBON 1.2K 5% 1/6W	
R012	1-247-839-00	CARBON 2.2K 5% 1/6W	
R013	1-247-831-00	CARBON 1K 5% 1/6W	
R014	1-247-831-00	CARBON 1K 5% 1/6W	
R015	1-247-831-00	CARBON 1K 5% 1/6W	
R016	1-247-831-00	CARBON 1K 5% 1/6W	
R017	1-247-819-00	CARBON 330 5% 1/6W	

When indicating parts by reference number, please include the board name.

Ref.No	Part No.	Description				Remark
R018	1-247-849-00	CARBON	5.6K	5%	1/6W	
R019	1-247-829-00	CARBON	820	5%	1/6W	
R020	1-247-829-00	CARBON	820	5%	1/6W	
R021	1-247-829-00	CARBON	820	5%	1/6W	
R022	1-247-819-00	CARBON	330	5%	1/6W	
R023	1-247-821-00	CARBON	390	5%	1/6W	
R024	1-247-845-00	CARBON	3.9K	5%	1/6W	
R025	1-247-827-00	CARBON	680	5%	1/6W	
R026	1-247-869-00	CARBON	39K	5%	1/6W	
R027	1-247-843-00	CARBON	3.3K	5%	1/6W	
R028	1-247-867-00	CARBON	33K	5%	1/6W	
R029	1-247-867-00	CARBON	33K	5%	1/6W	
R030	1-247-885-00	CARBON	180K	5%	1/6W	
R031	1-249-429-11	CARBON	10K	5%	1/6W	
R032	1-247-887-00	CARBON	220K	5%	1/6W	
R033	1-247-851-00	CARBON	6.8K	5%	1/6W	
R034	1-249-437-11	CARBON	47K	5%	1/6W	
R035	1-247-839-00	CARBON	2.2K	5%	1/6W	
R036	1-247-859-00	CARBON	15K	5%	1/6W	
R037	1-247-831-00	CARBON	1K	5%	1/6W	
R038	1-249-429-11	CARBON	10K	5%	1/6W	
R039	1-247-831-00	CARBON	1K	5%	1/6W	
R040	1-249-425-11	CARBON	4.7K	5%	1/6W	
R041	1-249-425-11	CARBON	4.7K	5%	1/6W	
R042	1-249-425-11	CARBON	4.7K	5%	1/6W	
R043	1-249-425-11	CARBON	4.7K	5%	1/6W	
R044	1-247-863-00	CARBON	22K	5%	1/6W	
R045	1-247-877-00	CARBON	82K	5%	1/6W	
R046	1-247-859-00	CARBON	15K	5%	1/6W	
R047	1-247-857-00	CARBON	12K	5%	1/6W	
R048	1-247-859-00	CARBON	15K	5%	1/6W	
R049	1-247-843-00	CARBON	3.3K	5%	1/6W	
R050	1-247-891-00	CARBON	330K	5%	1/6W	
R051	1-247-839-00	CARBON	2.2K	5%	1/6W	
R052	1-247-877-00	CARBON	82K	5%	1/6W	
R053	1-247-881-00	CARBON	120K	5%	1/6W	
R054	1-247-863-00	CARBON	22K	5%	1/6W	
R055	1-247-839-00	CARBON	2.2K	5%	1/6W	
R056	1-247-895-00	CARBON	470K	5%	1/6W	
R057	1-247-877-00	CARBON	82K	5%	1/6W	
R058	1-247-857-00	CARBON	12K	5%	1/6W	
R059	⚠ 1-247-720-11	CARBON	3.9K	5%	1/4W	F
R060	1-247-863-00	CARBON	22K	5%	1/6W	
R061	1-247-863-00	CARBON	22K	5%	1/6W	
R062	1-247-863-00	CARBON	22K	5%	1/6W	
R063	1-247-863-00	CARBON	22K	5%	1/6W	
R064	1-247-775-00	CARBON	4.7	5%	1/6W	
R065	1-247-839-00	CARBON	2.2K	5%	1/6W	
R066	1-249-425-11	CARBON	4.7K	5%	1/6W	
R067	1-247-831-00	CARBON	1K	5%	1/6W	
R068	1-247-841-00	CARBON	2.7K	5%	1/6W	
R069	1-247-831-00	CARBON	1K	5%	1/6W	
R070	1-249-419-11	CARBON	1.5K	5%	1/6W	

Ref.No	Part No.	Description				Remark
R071	1-247-831-00	CARBON	1K	5%	1/6W	
R072	1-247-879-00	CARBON	100K	5%	1/6W	
R073	1-247-879-00	CARBON	100K	5%	1/6W	
R074	1-247-903-00	CARBON	1M	5%	1/6W	
R075	1-247-867-00	CARBON	33K	5%	1/6W	
R076	1-249-429-11	CARBON	10K	5%	1/6W	
R077	1-249-425-11	CARBON	4.7K	5%	1/6W	
R078	1-247-843-00	CARBON	3.3K	5%	1/6W	
R079	1-249-429-11	CARBON	10K	5%	1/6W	
R080	1-247-883-00	CARBON	150K	5%	1/6W	
R081	1-247-887-00	CARBON	220K	5%	1/6W	
R082	1-247-843-00	CARBON	3.3K	5%	1/6W	
R083	1-247-863-00	CARBON	22K	5%	1/6W	
R084	1-247-863-00	CARBON	22K	5%	1/6W	
R085	1-247-783-00	CARBON	10	5%	1/6W	
R086	1-247-867-00	CARBON	33K	5%	1/6W	
R088	1-247-857-00	CARBON	12K	5%	1/6W	
R089	1-249-429-11	CARBON	10K	5%	1/6W	
R090	1-249-429-11	CARBON	10K	5%	1/6W	
R091	1-249-425-11	CARBON	4.7K	5%	1/6W	
R092	1-249-429-11	CARBON	10K	5%	1/6W	
R093	1-249-425-11	CARBON	4.7K	5%	1/6W	
R094	1-249-425-11	CARBON	4.7K	5%	1/6W	
R095	1-247-837-00	CARBON	1.8K	5%	1/6W	
R098	1-247-845-00	CARBON	3.9K	5%	1/6W	
R099	1-247-833-00	CARBON	1.2K	5%	1/6W	
R100	1-247-829-00	CARBON	820	5%	1/6W	
R101	1-249-429-11	CARBON	10K	5%	1/6W	
R102	1-249-429-11	CARBON	10K	5%	1/6W	
R103	1-247-879-00	CARBON	100K	5%	1/6W	
R104	1-247-859-00	CARBON	15K	5%	1/6W	
R105	1-247-879-00	CARBON	100K	5%	1/6W	
R106	1-247-863-00	CARBON	22K	5%	1/6W	
R107	1-247-803-00	CARBON	68	5%	1/6W	
R109	1-247-831-00	CARBON	1K	5%	1/6W	
R110	1-247-875-00	CARBON	68K	5%	1/6W	
R111	1-247-903-00	CARBON	1M	5%	1/6W	
R112	1-247-863-00	CARBON	22K	5%	1/6W	
R114	1-249-429-11	CARBON	10K	5%	1/6W	
R115	1-247-867-00	CARBON	33K	5%	1/6W	
R116	1-247-863-00	CARBON	22K	5%	1/6W	
R117	1-249-434-11	CARBON	27K	5%	1/6W	
R118	1-247-867-00	CARBON	33K	5%	1/6W	
R119	1-247-843-00	CARBON	3.3K	5%	1/6W	

VARIABLE RESISTOR

RV001	1-228-993-00	RES, ADJ, CARBON 4.7K
RV002	1-228-996-00	RES, ADJ, CARBON 47K
RV003	1-228-995-00	RES, ADJ, CARBON 22K

FILTER

SWF001	1-404-438-00	FILTER, SAW

The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

Ref.No	Part No.	Description	Remark
		MISCELLANEOUS	
	A-7090-029-A	M-SW ASSY	
	X-3686-549-1	L-SW ASSY	
	⚠ 1-464-589-11	BOOSTER RF MODULATOR (RFU-844(AS))	
	⚠ 1-551-732-00	CORD, POWER	
	1-535-535-11	TERMIANL, SHAFT GROUND	
	*1-555-110-00	CABLE, PIN	
C901	1-161-057-00	CAP, CERAMIC 0.033MF	
M902	8-838-094-01	MOTOR, DC (BHF-2800C) (CAPSTAN)	
M903	8-835-110-01	MOTOR, DC (DNR-5301A) (CONTROL)	
M904	⚠ A-7090-030-A	MOTOR ASSY, L (LOADING)	
PM901	⚠ 1-454-377-11	SOLENOID, PLUNGER (BRAKE)	
S901	1-554-942-11	SWITCH, PUSH (RECOG R)	
S902	1-554-942-11	SWITCH, PUSH (RECOG L)	
T101	⚠ 1-448-236-11	TRANSFORMER, POWER	
		ACCESSORYS AND PACKING MATERIALS	
	A-6765-736-A	COMMANDER ASSY	
	1-551-734-11	CORD, CONNECTION	
	1-551-513-00	CABLE, COAXAL ASSY	
	1-557-851-11	CABLE, VIDEO MONITOR	
	*3-689-588-31	INDIVIDUAL CARTON	(Australian Model)
	*3-689-589-01	CUSHION (UPPER)	
	*3-689-590-01	CUSHION (LOWER)	
	3-694-484-01	DRIVER, VOLUME	
	3-701-628-00	BAG, POLYETHYLENE	
	3-701-630-00	BAG, POLYETHYLENE	
	3-760-430-11	MANUAL, INSTRUCTION	
	3-764-357-41	INSTRUCTION (ENGLISH)	(AEP/UK/Australian Model)

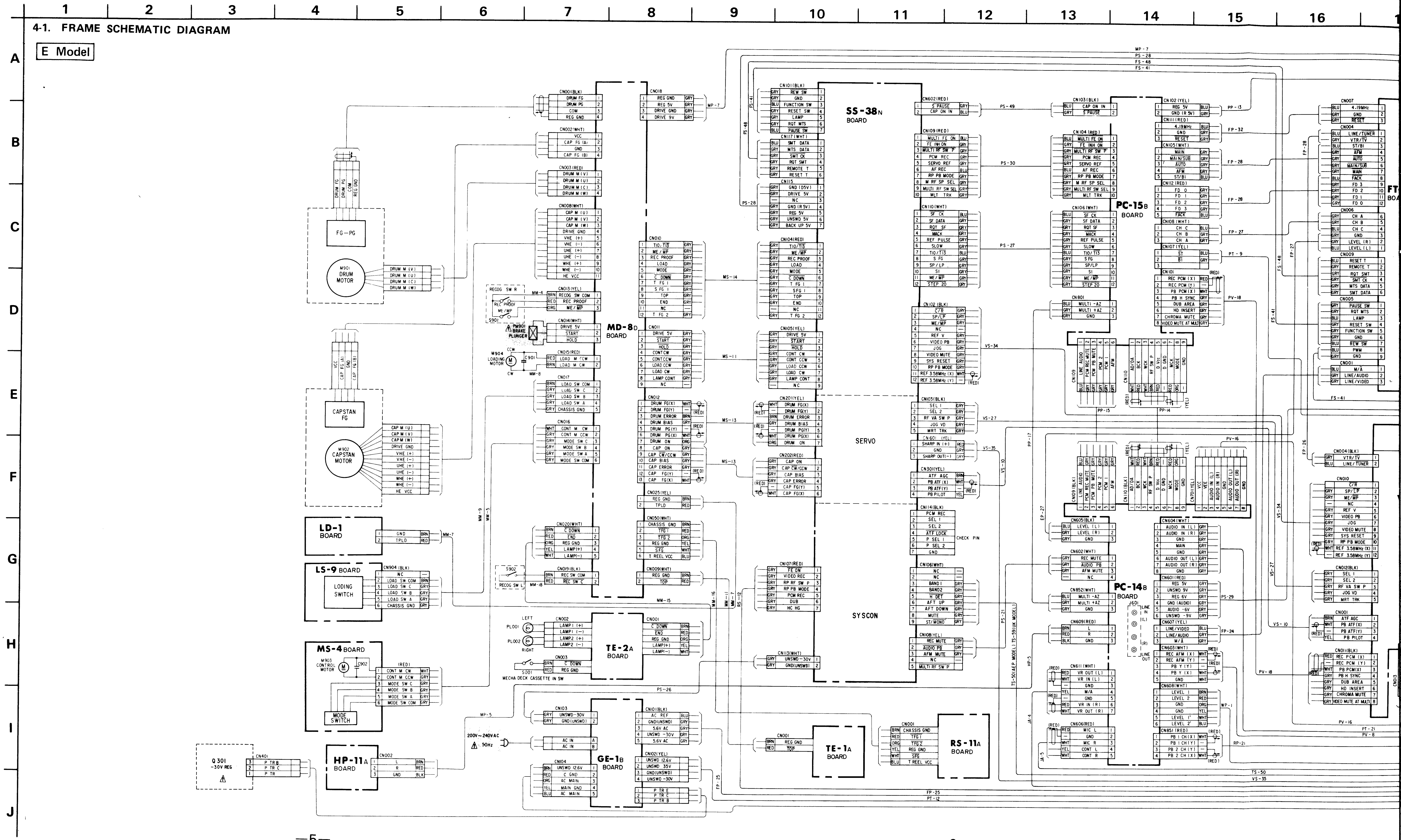
The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

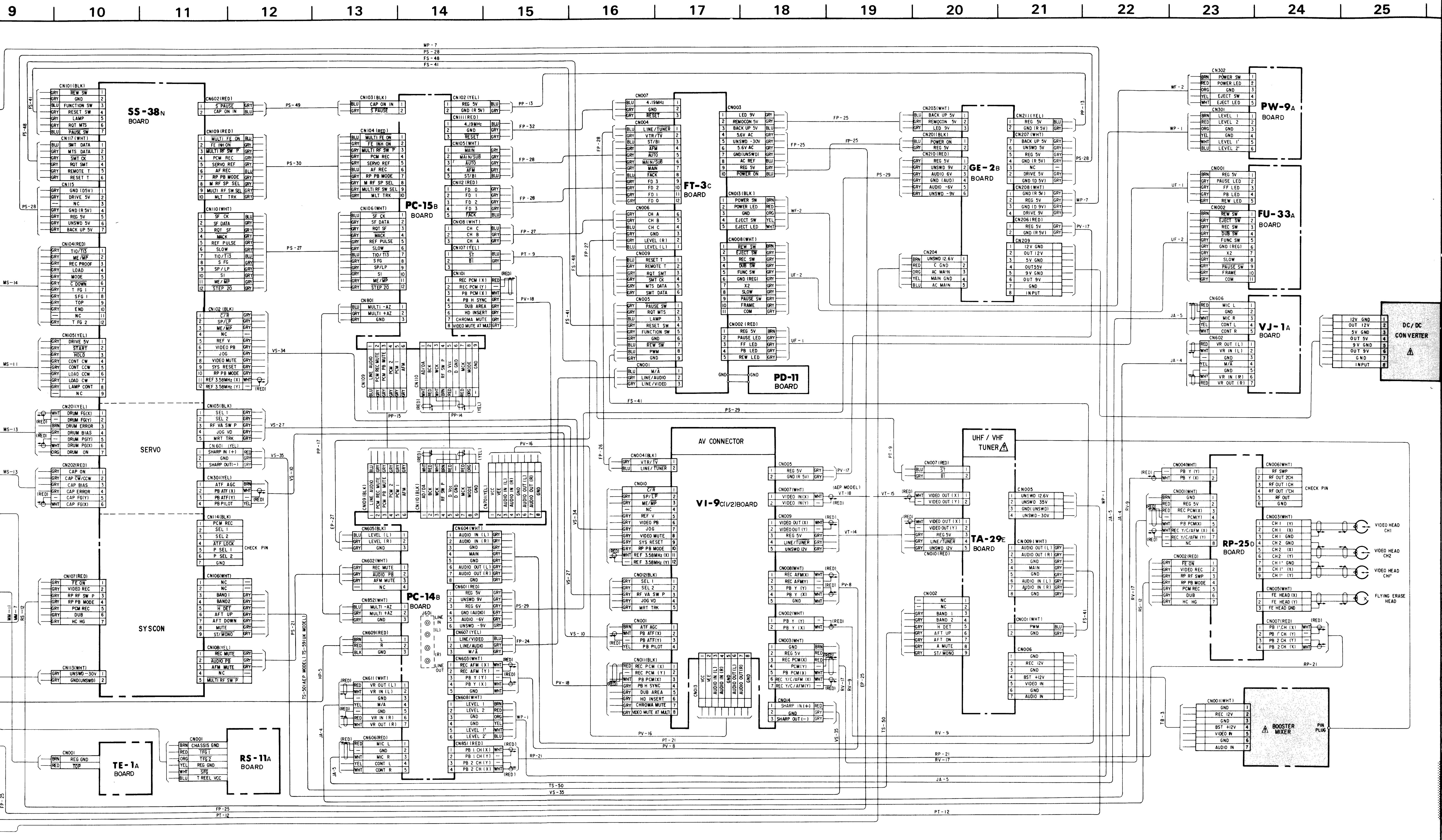
When indicating parts by reference number, please include the board name.

4. PRINTED WIRING BOARDS AND SCHEMATIC DIAGRAMS

4-1. FRAME SCHEMATIC DIAGRAM

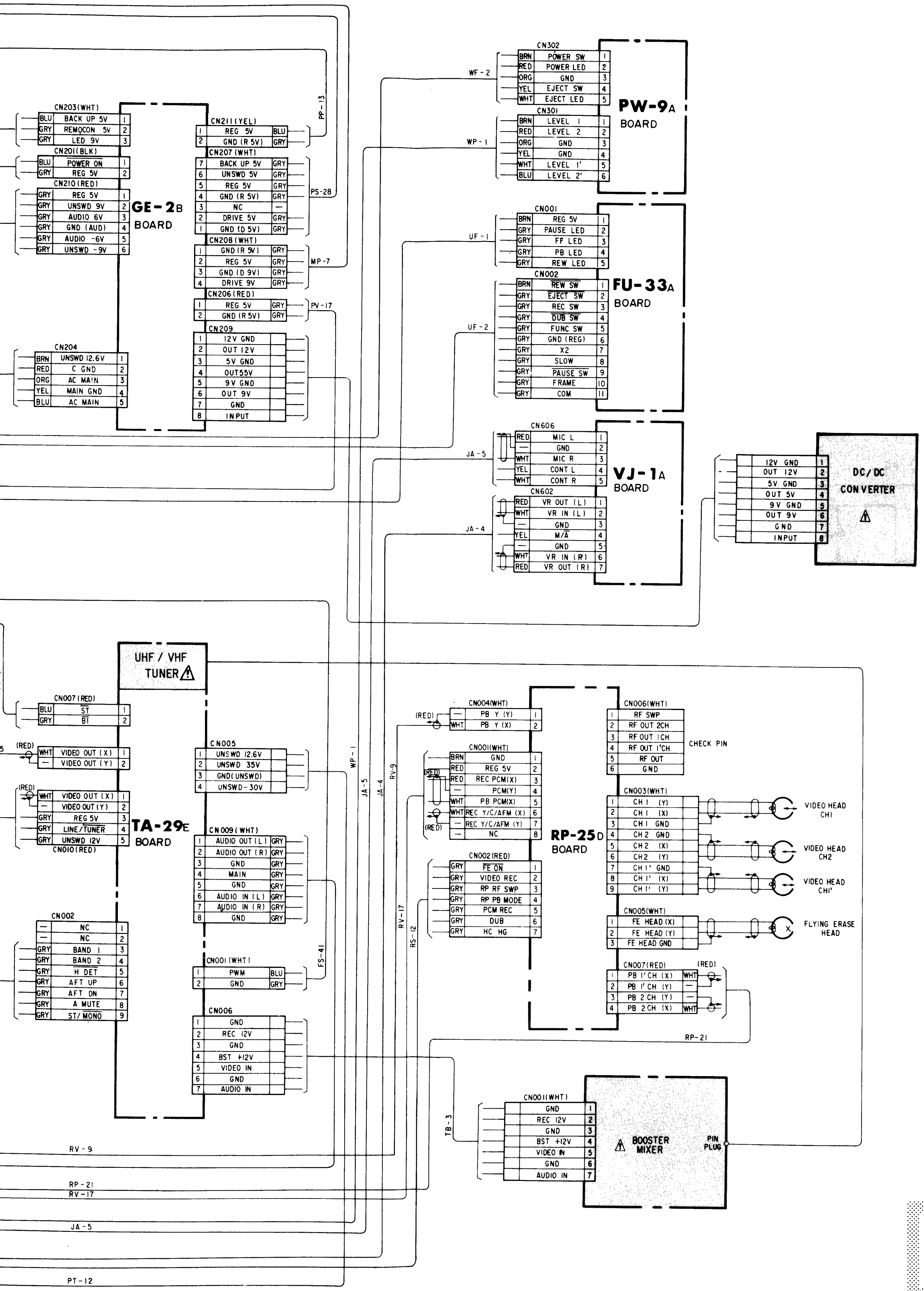
E Model




9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
SS-38N BOARD
SERVO
SYSCON
PC-15B BOARD
PC-14B BOARD
FT-3C BOARD
PD-11 BOARD
GE-2B BOARD
PW-9A BOARD
FU-33A BOARD
VJ-1A BOARD
DC/DC CONVERTER
AV CONNECTOR
VI-9C(1/2)BOARD
UHF / VHF TUNER
TA-29E BOARD
RP-25D BOARD
BOOSTER MIXER
PIN PLUG
TE-1A BOARD
RS-11A BOARD
CHECK PIN
VIDEO HEAD CH1
VIDEO HEAD CH2
VIDEO HEAD CH1'
FLYING ERASE HEAD

FRAME FRAME

20	21	22	23	24	25	26	27	28

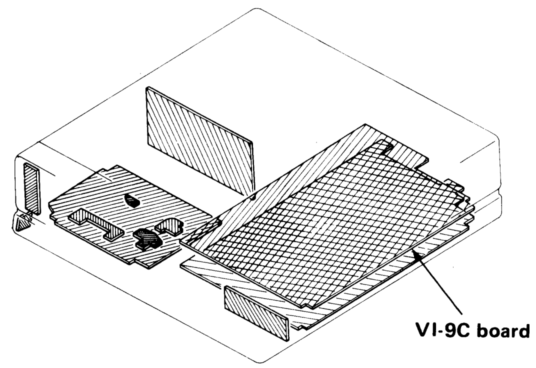


Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

4-2. PRINTED WIRING BOARDS AND SCHEMATIC DIAGRAMS

Note (Printed Wiring Board):

- ○— : parts extracted from the component side.
- ●— : parts extracted from the conductor side.
- ▒ : conductor side pattern.
- ░ : B + pattern.
- Digital transistor (VI-9C: Q002, 011, 014, 015, 017, 021, 100, 101, 107, 108, 109, 111, 201, 205, 207, 213, 214, 218, 258, 300, 401) transistor with resistors.
  Refer to the VI-9C board schematic diagram for digital transistor.



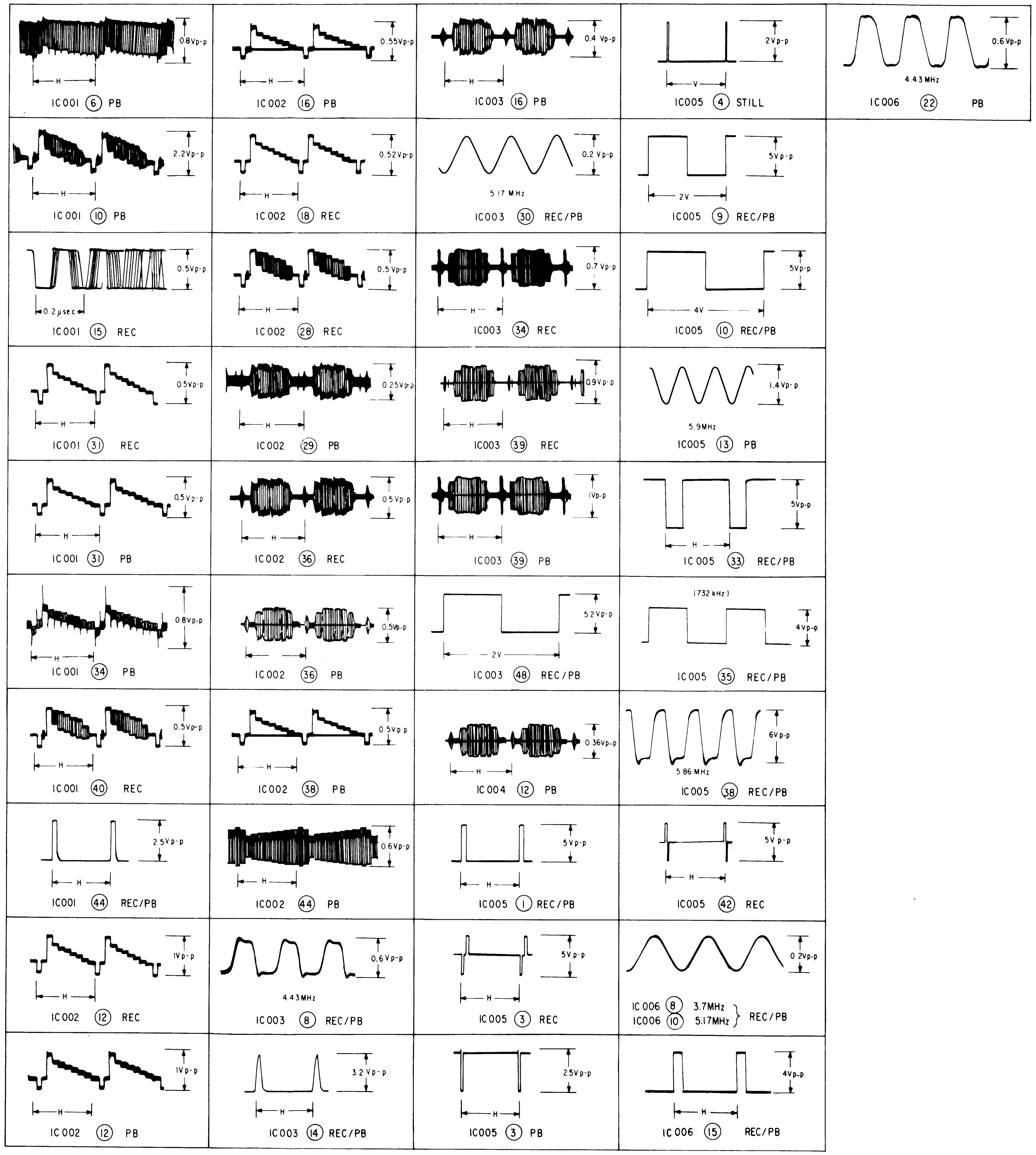
Note (Schematic Diagram):

- All capacitors are in μF unless otherwise noted, pF : $\mu\mu$F 50WV or less are not indicated except for electrolytics and tantalums.
- All resistors are in ohms, 1/6W unless otherwise noted.
  kΩ : 1000Ω, MΩ : 1000kΩ.
- All variable and semi-fixed resistors have characteristics curve B, unless otherwise noted.
- : nonfiammable resistor.
- : fusible resistor.
- : panel disignation.
- : adjustment for repair.
- : B + bus.
- The voltage value is a reference value between the grounding when the color bar signal is received from a color bar generator.
- All voltage are dc measured with a VOM (10MΩ)

Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

VI-9C BOARD

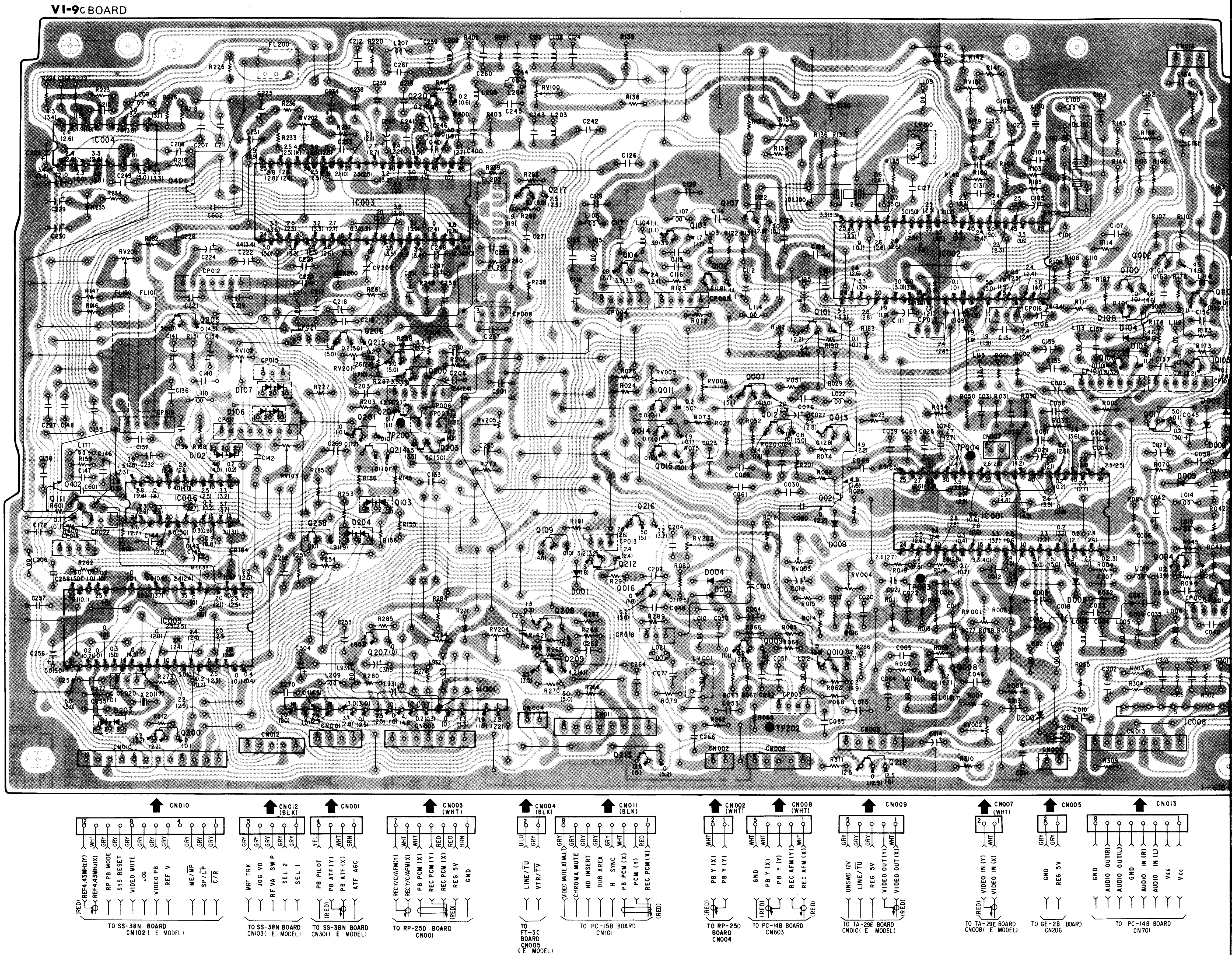


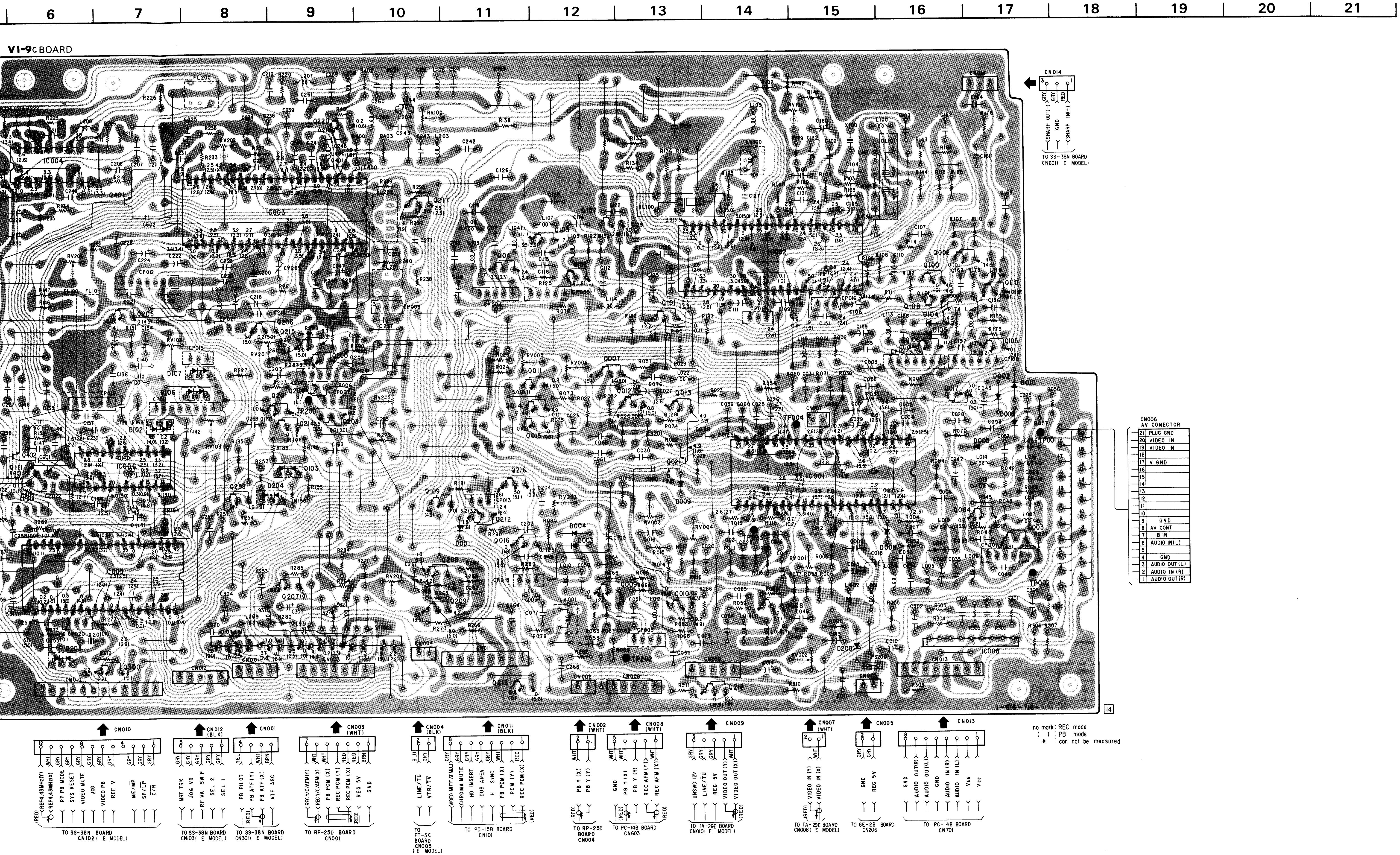
VI-9C (VIDEO) PRINTED WIRING BOARD

– Ref. No. VI-9C BOARD: 1000 series –

E Model

Row	IC, Q	D	ADJ	TP
B	220, IC004		101, 100, 202	
C	IC003, 217, 107, IC002, 103, 002, 104, 102, 100		206	
D	110, 205, 101, 108, 206, 215, 106, 105, 200, 007	104, 105	201, 102, 005, 006	
E	011, 204, 012, 013, 017, 201, 014, 015, 203, 214	107, 010, 106, 002, 102, 006	205, 103	200, 001
F	IC006, 111, 216, IC001, 258, 109, 004	005, 103, 009, 204, 001, 008, 004, 003	203, 003, 004	003
G	016, 003, IC005, 208, 207, 009, 010, 008, 209		001, 204	002
H	IC007, IC008, 300, 213, 218	200, 203	002	202



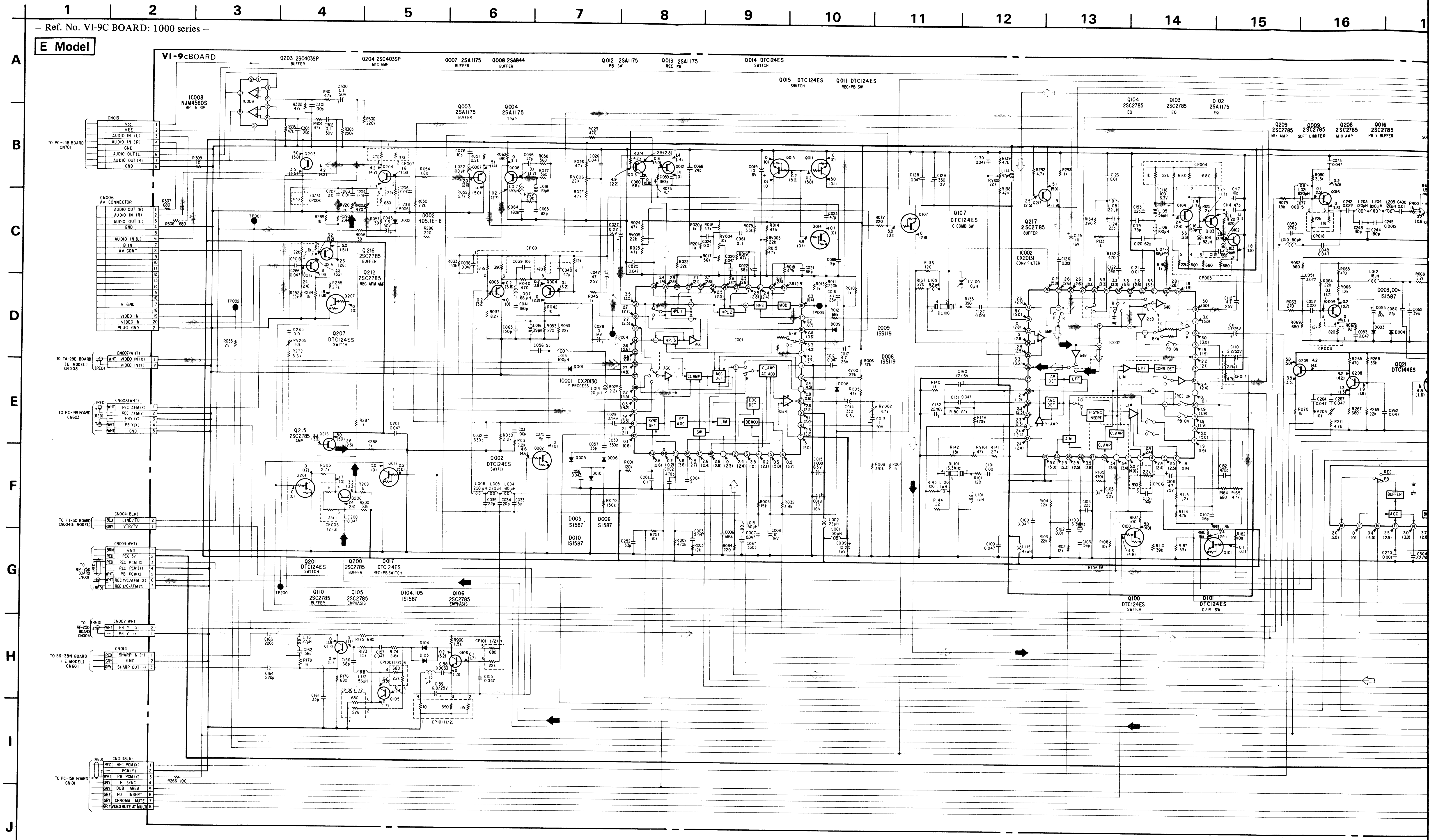


no mark : REC mode
( ) : PB mode
* : can not be measured

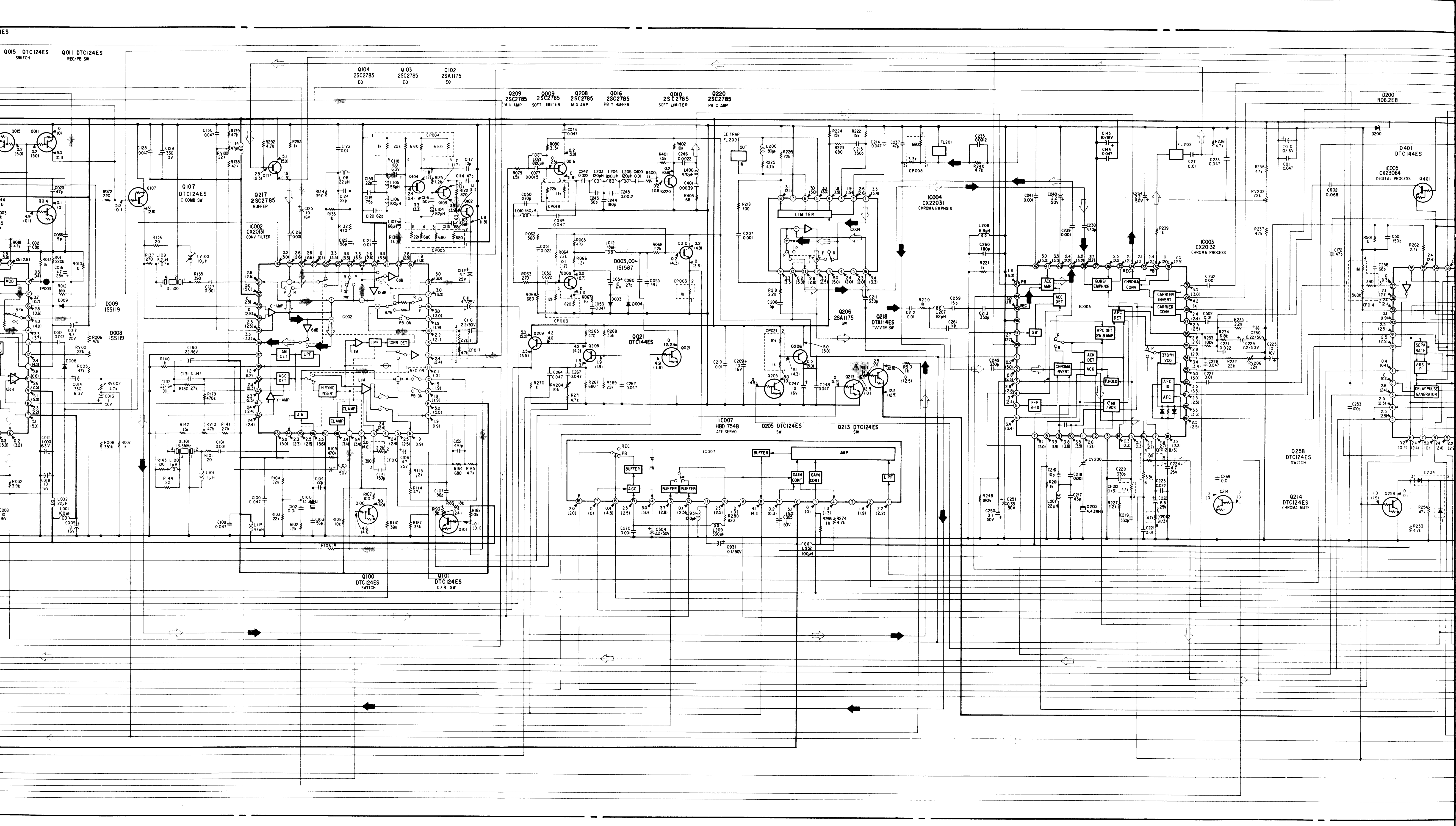
VI-9C (VIDEO) SCHEMATIC DIAGRAM

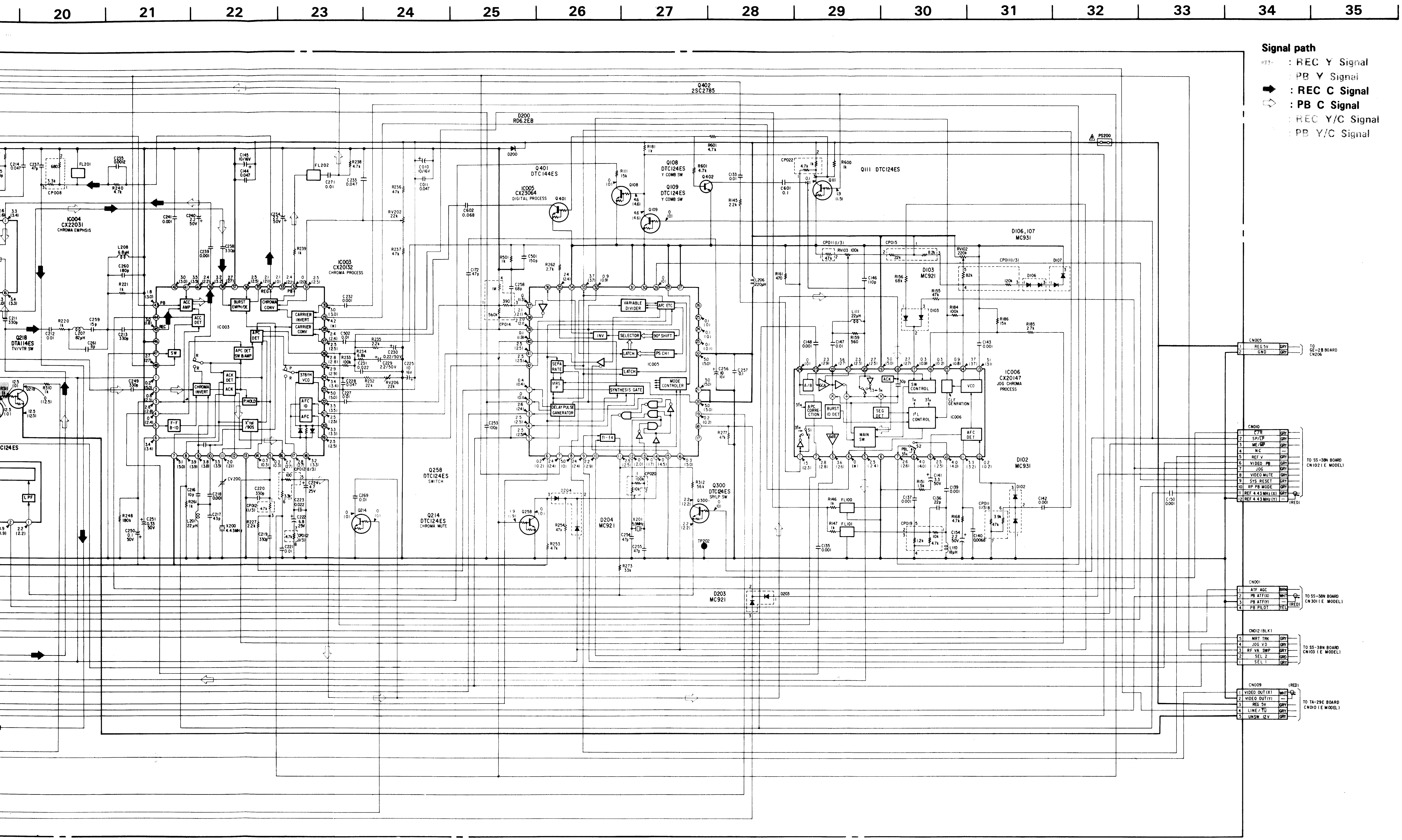
– Ref. No. VI-9C BOARD: 1000 series –

E Model



10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

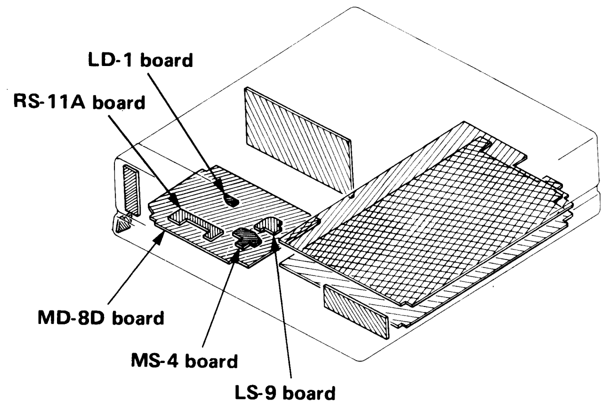


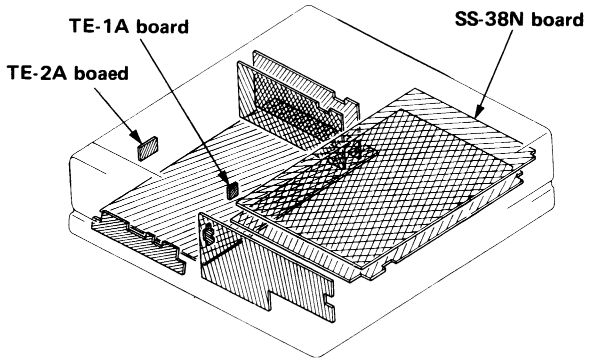

Signal path
: REC Y Signal
: PB Y Signal
: REC C Signal
: PB C Signal
: REC Y/C Signal
: PB Y/C Signal
IC004 CX22031 CHROMA EMPHSIS
IC003 CX20132 CHROMA PROCESS
IC005 CX23064 DIGITAL PROCESS
IC006 CX20147 JOG CHROMA PROCESS
Q401 DTC144ES
Q402 2SC2785
Q108 DTC124ES Y COMB SW
Q109 DTC124ES Y COMB SW
Q111 DTC124ES
Q218 DTA114ES TV/VTR SW
Q258 DTC124ES SWITCH
Q214 DTC124ES CHROMA MUTE
Q300 DTC124ES SP/LP SW
D200 RD6.2EB
D106,107 MC921
D103 MC921
D102 MC921
D203 MC921
D204 MC921
TO GE-28 BOARD CN206
TO SS-38N BOARD CN102 (E MODEL)
TO SS-38N BOARD CN301 (E MODEL)
TO SS-38N BOARD CN103 (E MODEL)
TO TA-29E BOARD CN010 (E MODEL)

Note (Printed Wiring Board):

- ○— : parts extracted from the component side.
- ●— : parts extracted from the conductor side.
- ▒ : conductor side pattern.
- ░ : B + pattern.

- Digital transistor (MD-8D: Q006, 100, 105, 106, 107, SS-38N: Q207, 211, 212, 213, 214, 215, 219, 221, 401, 402) transistor with resistors.
  Refer to the MD-8D, SS-38N boards schematic diagram for digital transistor.





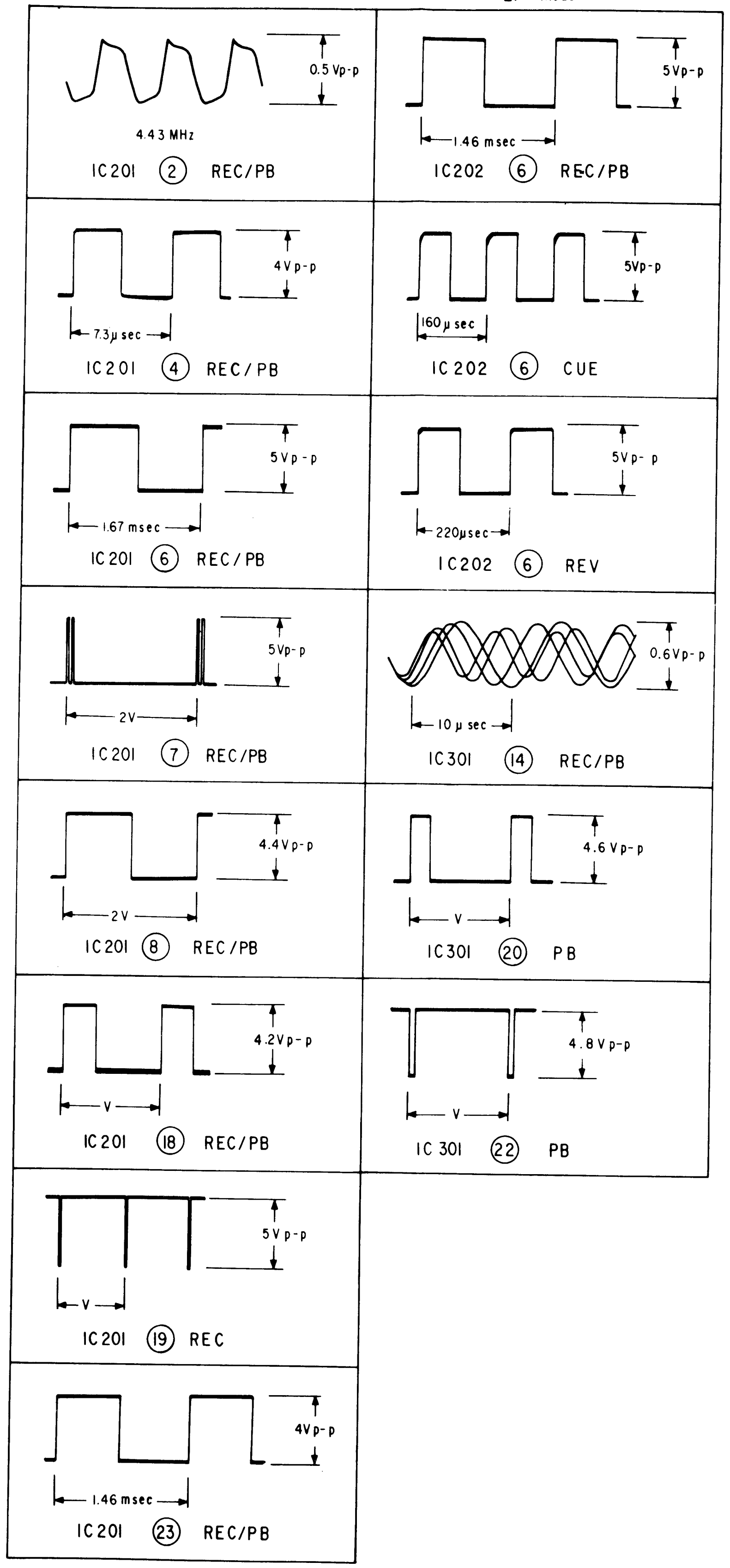
Note (Schematic Diagram):

- All capacitors are in μF unless otherwise noted, pF : $\mu\mu$F 50WV or less are not indicated except for electrolytics and tantalums.
- All resistors are in ohms, 1/6W unless otherwise noted.
  kΩ : 1000Ω, MΩ : 1000kΩ.
- All variable and semi-fixed resistors have characteristics curve B, unless otherwise noted.
- : nonfiammable resistor.
- : fusible resistor.
- : panel disignation.
- : adjustment for repair.
- : B + bus.
- The voltage value is a reference value between the grounding when the color bar signal is received from a color bar generator.
- All voltage are dc measured with a VOM (10MΩ)

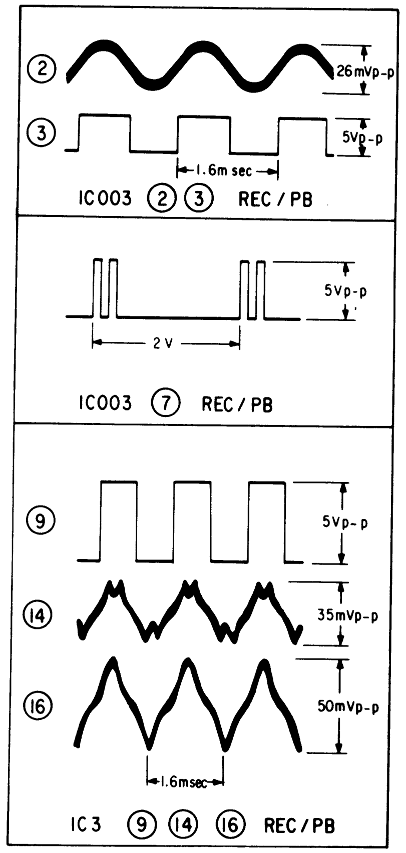
Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

SS-38N BOARD (SERVO)



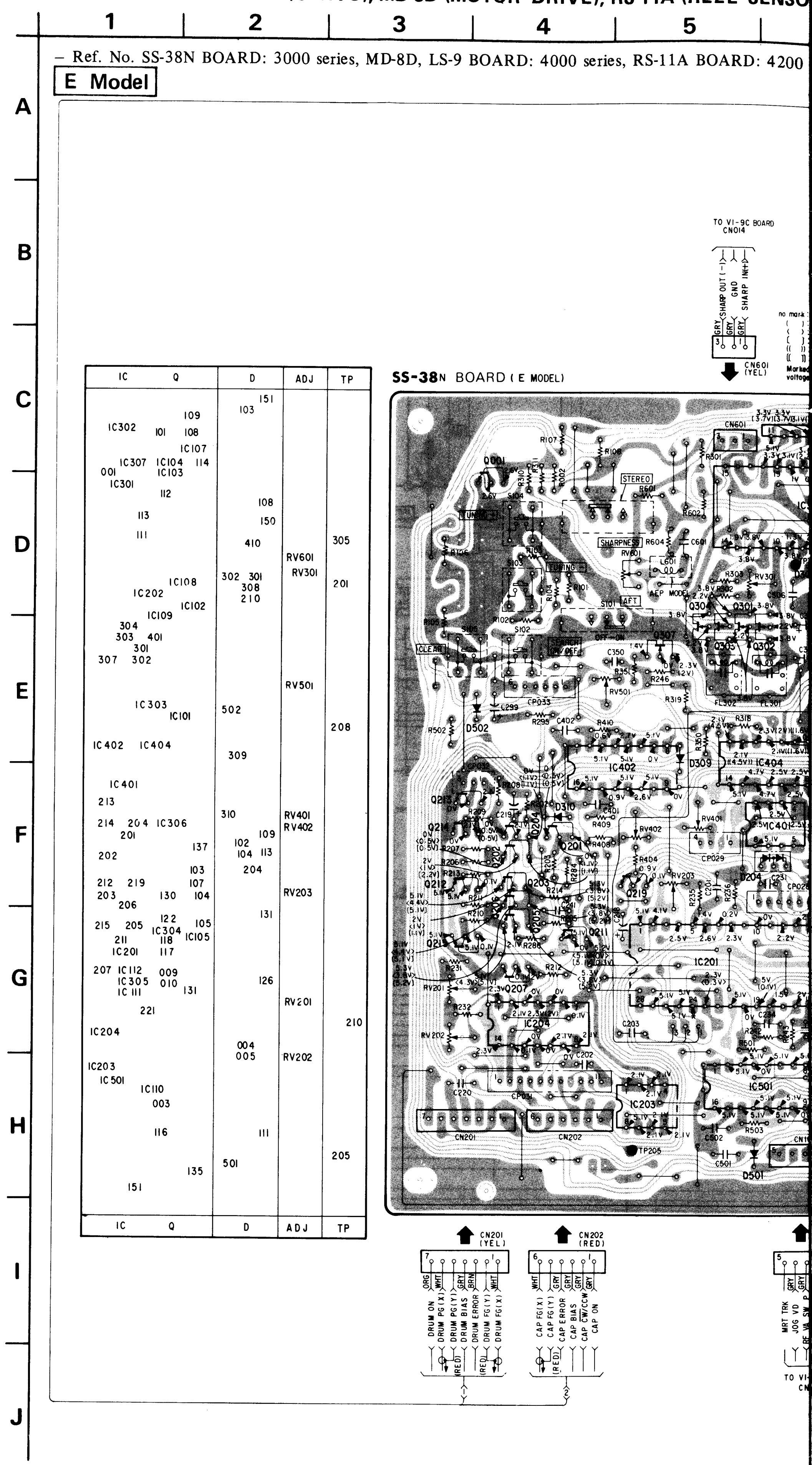
MD-8D BOARD



SS-38N (SYSTEM CONTROL/SERVO), MD-8D (MOTOR DRIVE), RS-11A (REEL SENSO

– Ref. No. SS-38N BOARD: 3000 series, MD-8D, LS-9 BOARD: 4000 series, RS-11A BOARD: 4200

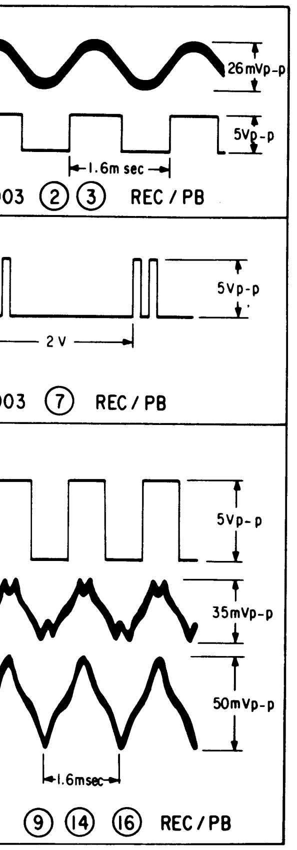
E Model



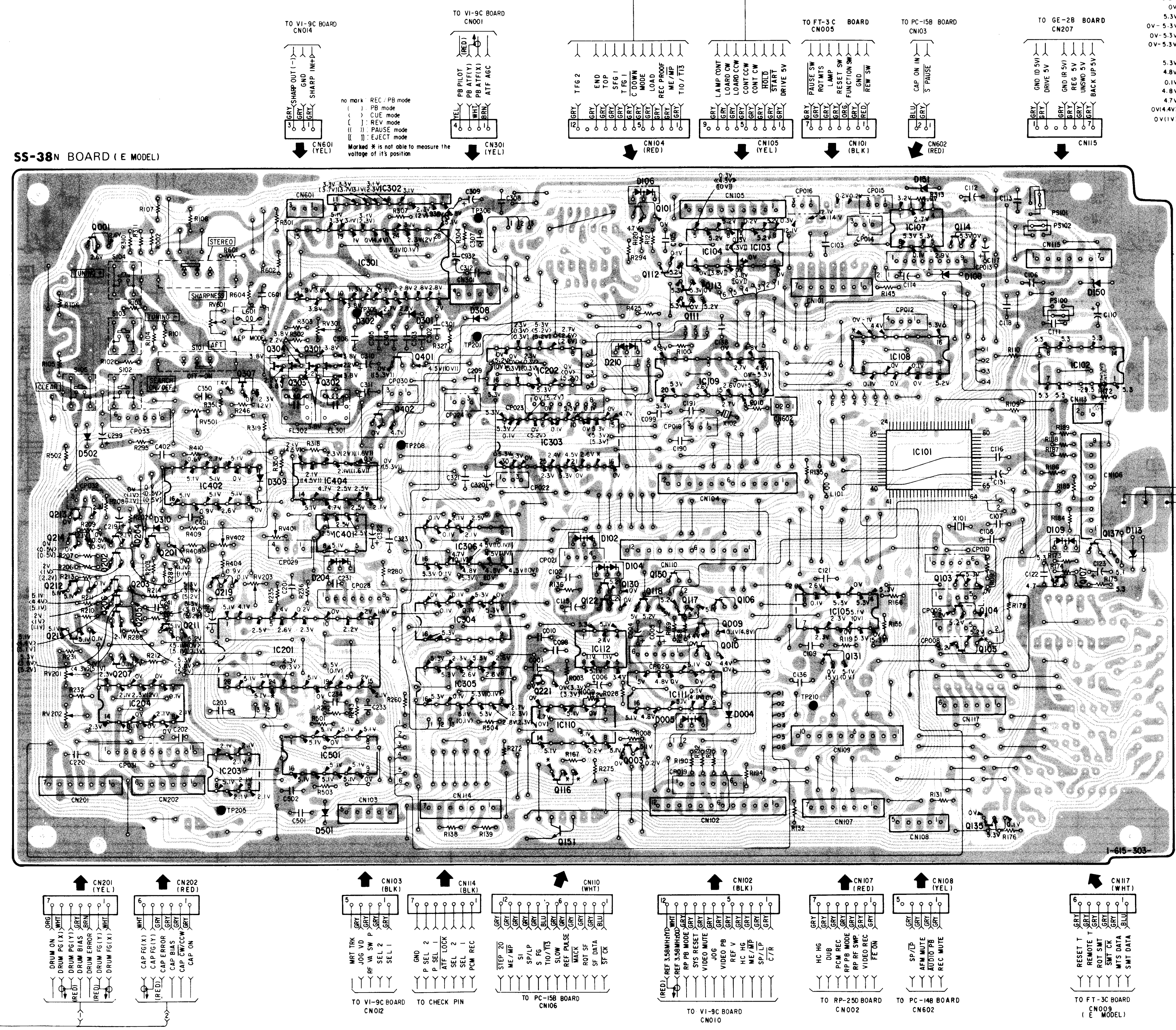
SS-38N (SYSTEM CONTROL/SERVO), MD-8D (MOTOR DRIVE), RS-11A (REEL SENSOR), TE-1A (TAPE-END SENSOR), TE-2A (TAPE-END SENSOR), MS-4 (MODE SWITCH/MODE CONTROL MOTOR DRIVE), LS-9 (LOADING SWITCH), LD-

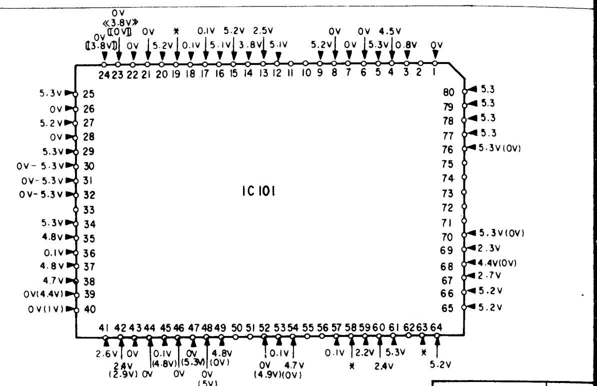
– Ref. No. SS-38N BOARD: 3000 series, MD-8D, LS-9 BOARD: 4000 series, RS-11A BOARD: 4200 series, LD-1 BOARD: 4400 series, TE-1A BOARD: 4600 series, TE-2A BOARD: 4800 series, MS-4 BOARD: 5000 series –

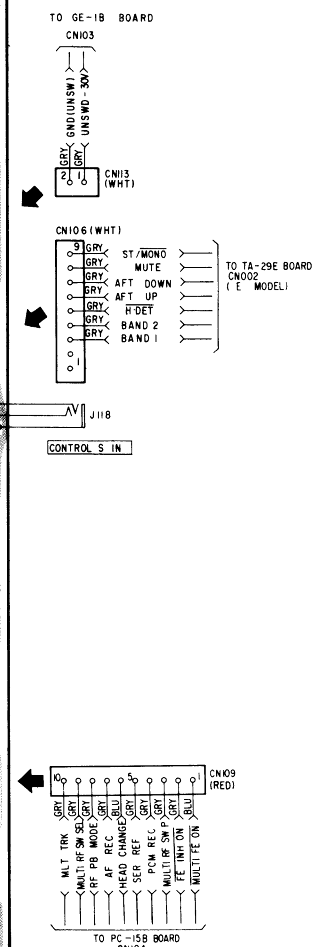
E Model



IC / Q	D	ADJ	TP
109 IC302 101 108 IC107 IC307 IC104 114 001 IC103 IC301 112 113 111	151 103 108 150 410	RV601 RV301	305 201
IC108 IC202 IC102 IC109 304 303 401 301 307 302	302 301 308 210		
IC303 IC101 IC402 IC404 IC401 213	502 309	RV501	208
214 204 IC306 201 137 202 103 107 212 219 203 130 104 206	310 109 102 104 113 204	RV401 RV402	
122 105 215 205 IC304 IC105 211 118 IC201 117 207 IC112 009 IC305 010 IC111 131 221	131 126	RV203 RV201	210
IC204 IC203 IC501 IC110 003 116 135 151	004 005 111 501	RV202	205
IC / Q	D	ADJ	TP

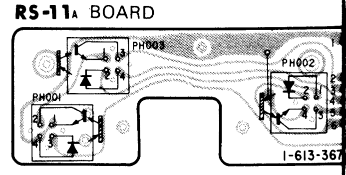






Q IC	D
	103
IC003	107
IC101	
IC004	003
105 106	104
IC001	108
	IC002
006	001
Q001	
101 100	002 004
Q IC	D

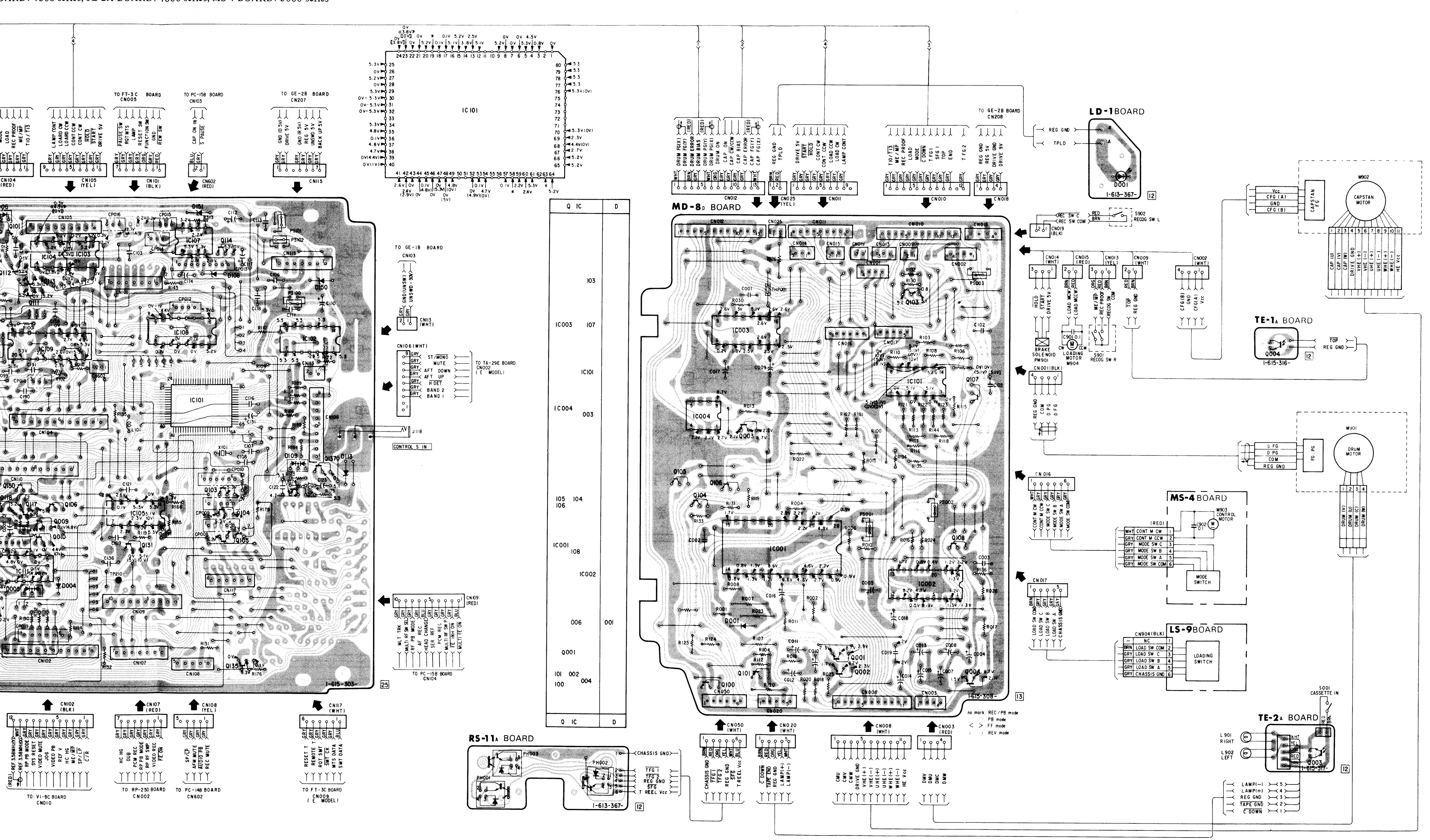
RS-11A BOARD



2A (TAPE-END SENSOR), MS-4 (MODE SWITCH/MODE CONTROL MOTOR DRIVE), LS-9 (LOADING SWITCH), LD-1 (TAPE SENSOR LIGHT EMISSION) PRINTED WIRING BOARD

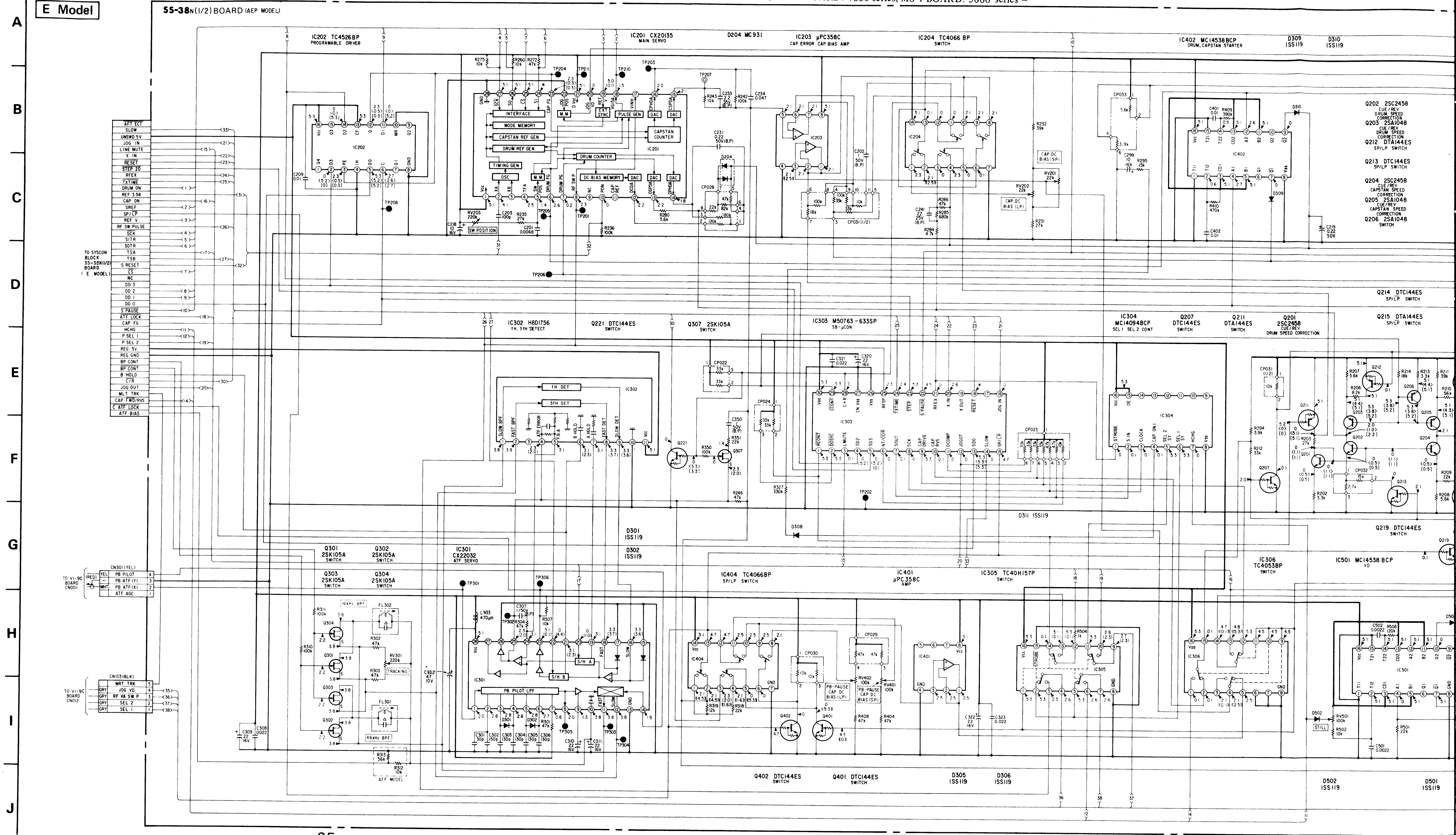
9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

OARD: 4600 series, TE-2A BOARD: 4800 series, MS-4 BOARD: 5000 series –



SS-38N (SYSTEM CONTROL/SERVO), MD-8D (MOTOR DRIVE), RS-11A (REEL SENSOR), TE-1A (TAPE-END SENSOR), TE-2A (TAPE-END SENSOR), MS-4 (MODE SWITCH/MODE CONTROL MOTOR DRIVE), LS-9 (LOADING SWITCH), LD-1 (TAPE SENSOR LIGHT E

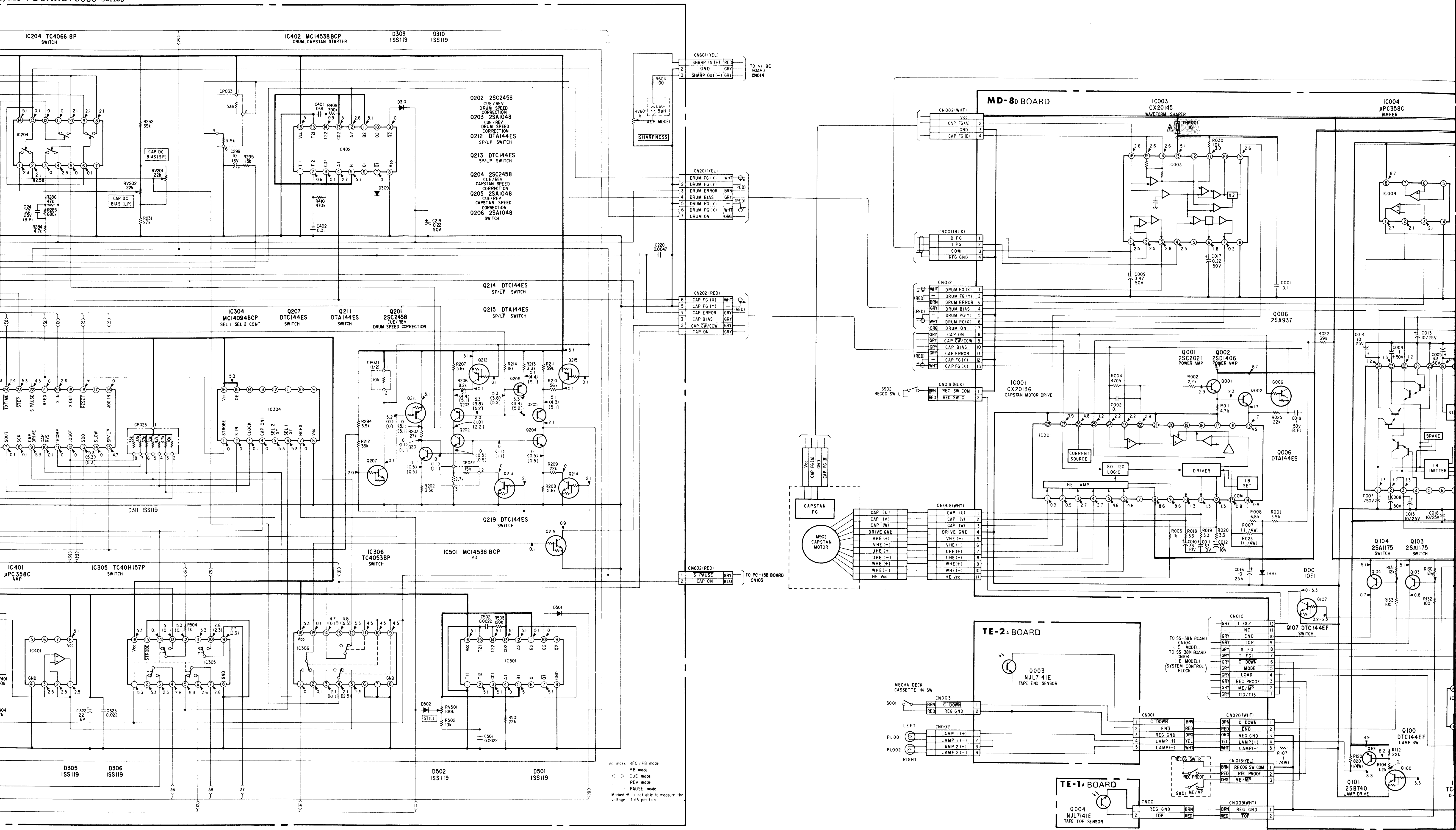
– Ref. No. SS-38N BOARD: 3000 series, MD-8D, LS-9 BOARD: 4000 series, RS-11A BOARD: 4200 series, LD-1 BOARD: 4400 series, TE-1A BOARD: 4600 series, TE-2A BOARD: 4800 series, MS-4 BOARD: 5000 series –



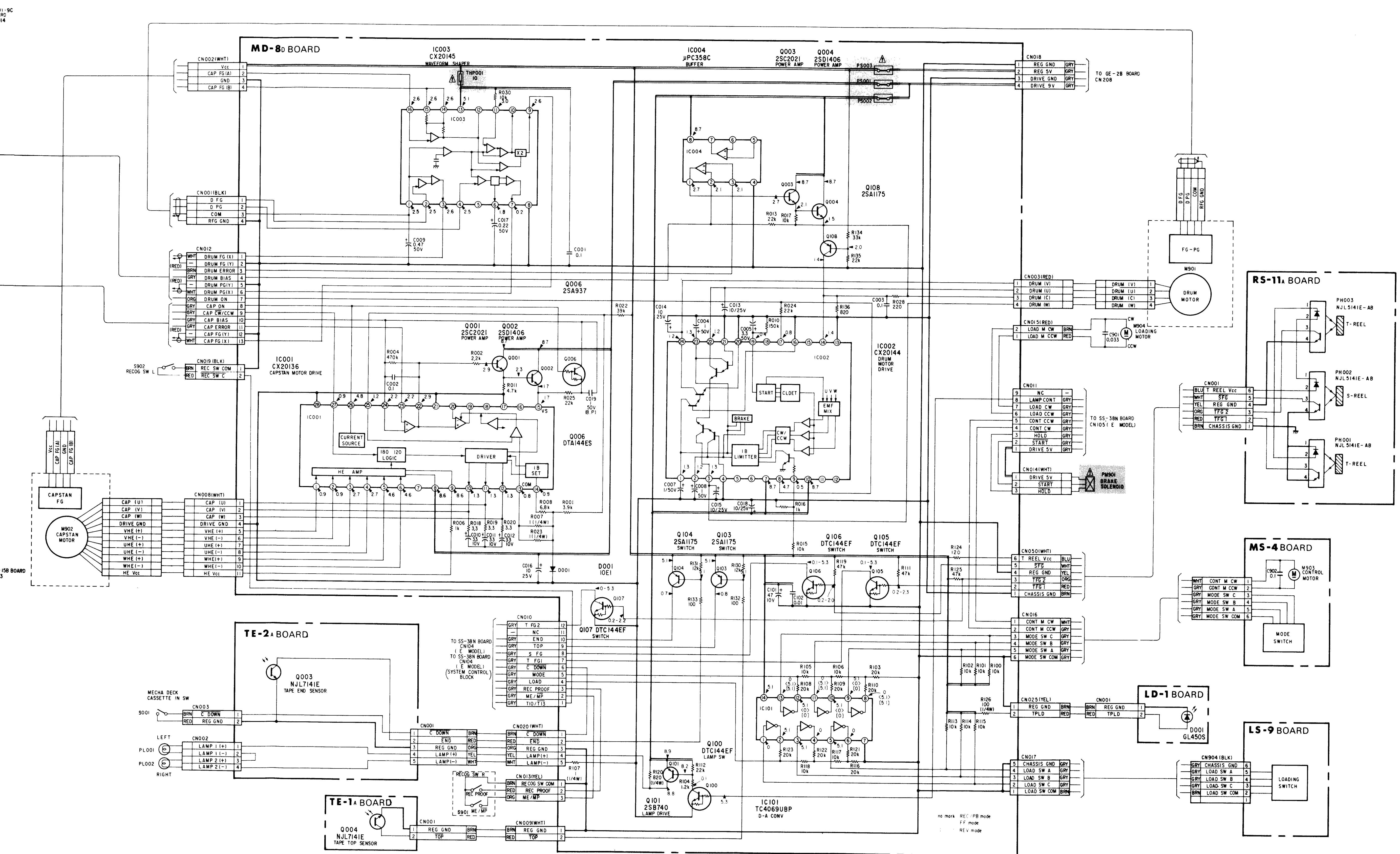
SWITCH/MODE CONTROL MOTOR DRIVE), LS-9 (LOADING SWITCH), LD-1 (TAPE SENSOR LIGHT EMISSION) SCHEMATIC DIAGRAM

11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27

s, MS-4 BOARD: 5000 series –



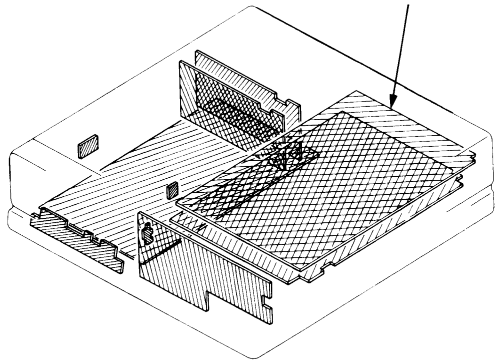
20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35



Note (Printed Wiring Board):

- ○— : parts extracted from the component side.
- ●— : parts extracted from the conductor side.
- ▒ : conductor side pattern.
- ░ : B + pattern.

- Digital transistor (SS-38N: Q001, 009, 010, 103, 111, 112, 113, 122, 130, 131, 137, 151) transistor with resistors. Refer to the SS-38N board schematic diagram for digital transistor.



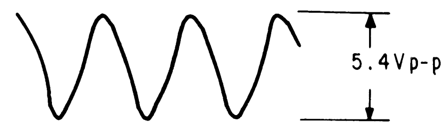
Note (Schematic Diagram):

- All capacitors are in μF unless otherwise noted, pF : $\mu\mu$F 50WV or less are not indicated except for electrolytics and tantalums.
- All resistors are in ohms, 1/6W unless otherwise noted. kΩ : 1000Ω, MΩ : 1000kΩ.
- All variable and semi-fixed resistors have characteristics curve B, unless otherwise noted.
- : nonfiammable resistor.
- : fusible resistor.
- : panel disignation.
- : adjustment for repair.
- : B + bus.
- : B – bus.
- The voltage value is a reference value between the grounding when the color bar signal is received from a color bar generator.
- All voltage are dc measured with a VOM (10MΩ)

Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

SS-38N BOARD (SYSCON)

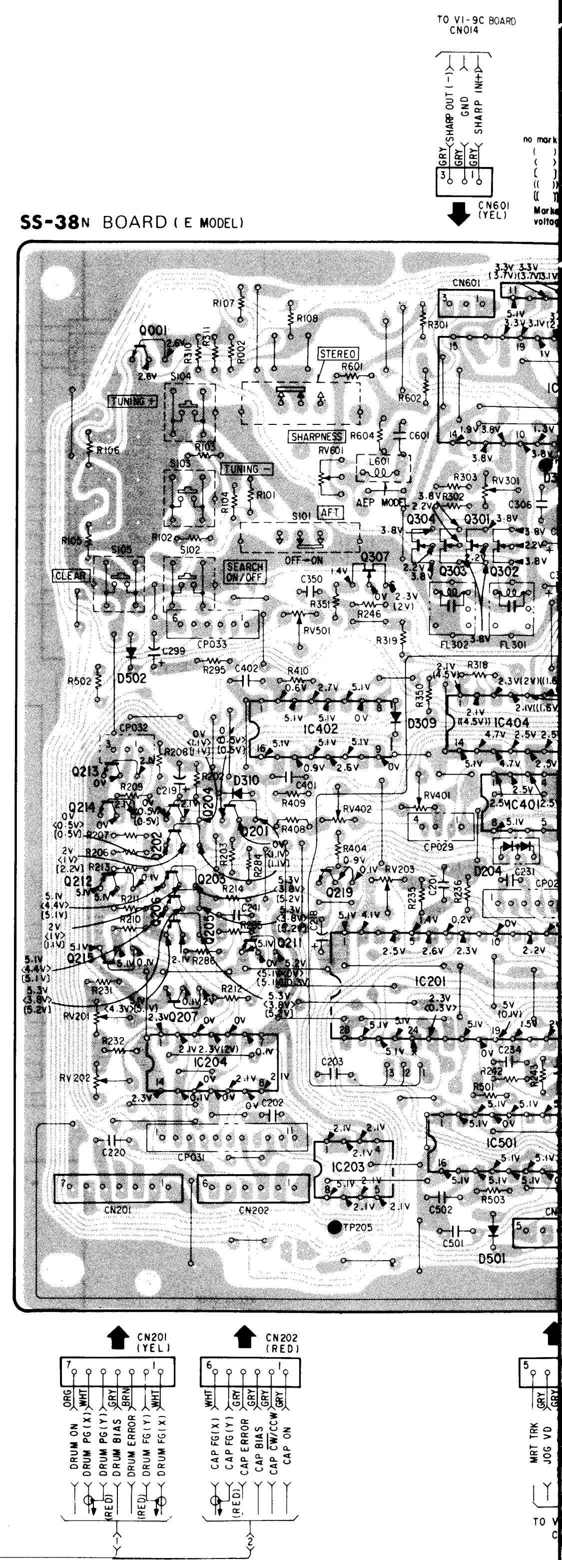


SS-38N (SYSTEM CONTROL/SERVO), MD-8D (MOTOR DRIVE), RS-11A (REEL SENSO

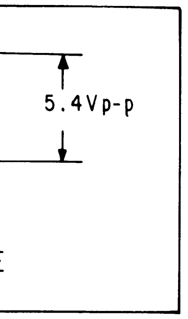
– Ref. No. SS-38N BOARD: 3000 series, MD-8D, LS-9 BOARD: 4000 series, RS-11A BOARD: 4200

E Model

IC / Q	D	ADJ	TP
	151		
	103		
109			
IC302 101 108			
IC107			
IC307 IC104 114			
001 IC103			
IC301			
112	108		
113	150		
111	410		305
		RV601	
IC108	302 301	RV301	201
IC202	308		
IC102	210		
IC109			
304			
303 401			
301			
307 302			
		RV501	
IC303	502		
IC101			
			208
IC402 IC404			
	309		
IC401			
213			
	310	RV401	
214 204 IC306		RV402	
201	109		
137	102		
	104 113		
202			
103	204		
212 219 107			
203 130 104		RV203	
206			
	131		
122			
215 205 105			
IC304			
211 118 IC105			
IC201 117			
207 IC112 009			
IC305 010	126		
IC111 131			
		RV201	
221			
			210
IC204			
	004		
	005	RV202	
IC203			
IC501			
IC110			
003			
116	111		
			205
	501		
135			
151			



ON)



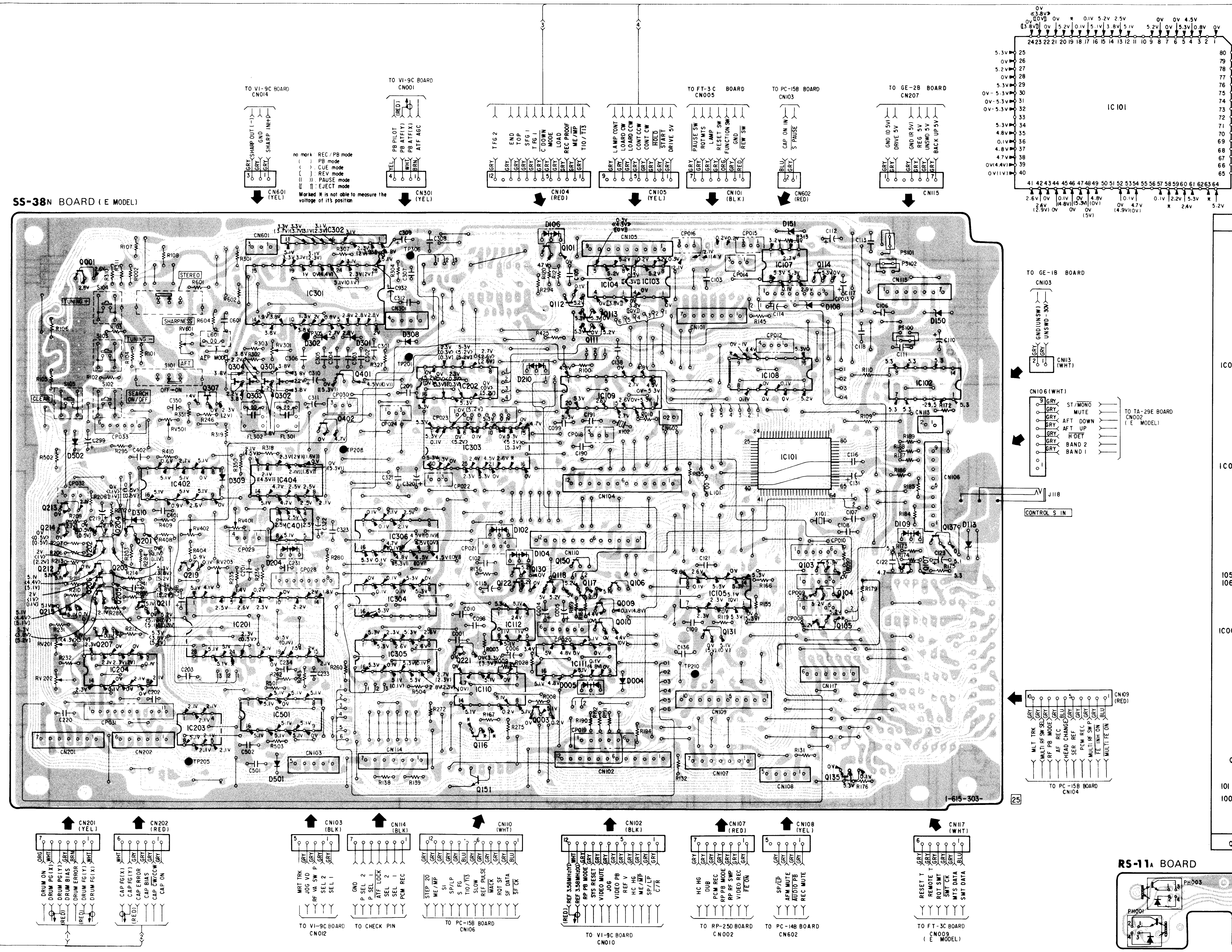
SS-38N (SYSTEM CONTROL/SERVO), MD-8D (MOTOR DRIVE), RS-11A (REEL SENSOR), TE-1A (TAPE-END SENSOR), TE-2A (TAPE-END SENSOR), MS-4 (MODE SWITCH/MODE CONTROL MOTOR DRIVE), LS-9 (LOADING SWITCH), LD-1 (TAPE S

– Ref. No. SS-38N BOARD: 3000 series, MD-8D, LS-9 BOARD: 4000 series, RS-11A BOARD: 4200 series, LD-1 BOARD: 4400 series, TE-1A BOARD: 4600 series, TE-2A BOARD: 4800 series, MS-4 BOARD: 5000 series –

E Model

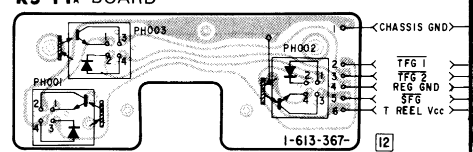
	IC	Q	D	ADJ	TP
C	IC302, IC307, IC104, IC107, IC103, IC301	109, 101, 108, 114, 001, 112	151, 103		
D	IC108, IC202, IC102, IC109	113, 111	108, 150, 410, 302, 301, 308, 210	RV601, RV301	305, 201
E	IC303, IC101	304, 303, 401, 301, 307, 302	502	RV501	208
F	IC402, IC404, IC401, IC306	213, 214, 204, 201, 137, 202	309, 310, 102, 104, 109, 113, 204	RV401, RV402	
G	IC304, IC105, IC112, IC305, IC111, IC201	212, 219, 203, 206, 130, 103, 107, 104, 215, 205, 122, 105, 211, 118, 117, 207, 009, 010, 131	131, 126	RV203, RV201	
H	IC204, IC203, IC501, IC110	221, 003, 116, 135, 151	004, 005, 111, 501	RV202	210, 205

SS-38N BOARD (E MODEL)



	Q	IC	D
D	107	IC003	103
E	003	IC101, IC004	
F	105, 104, 106		
G	108	IC001, IC002	
H	006, Q001, 101, 002, 004, 100		001

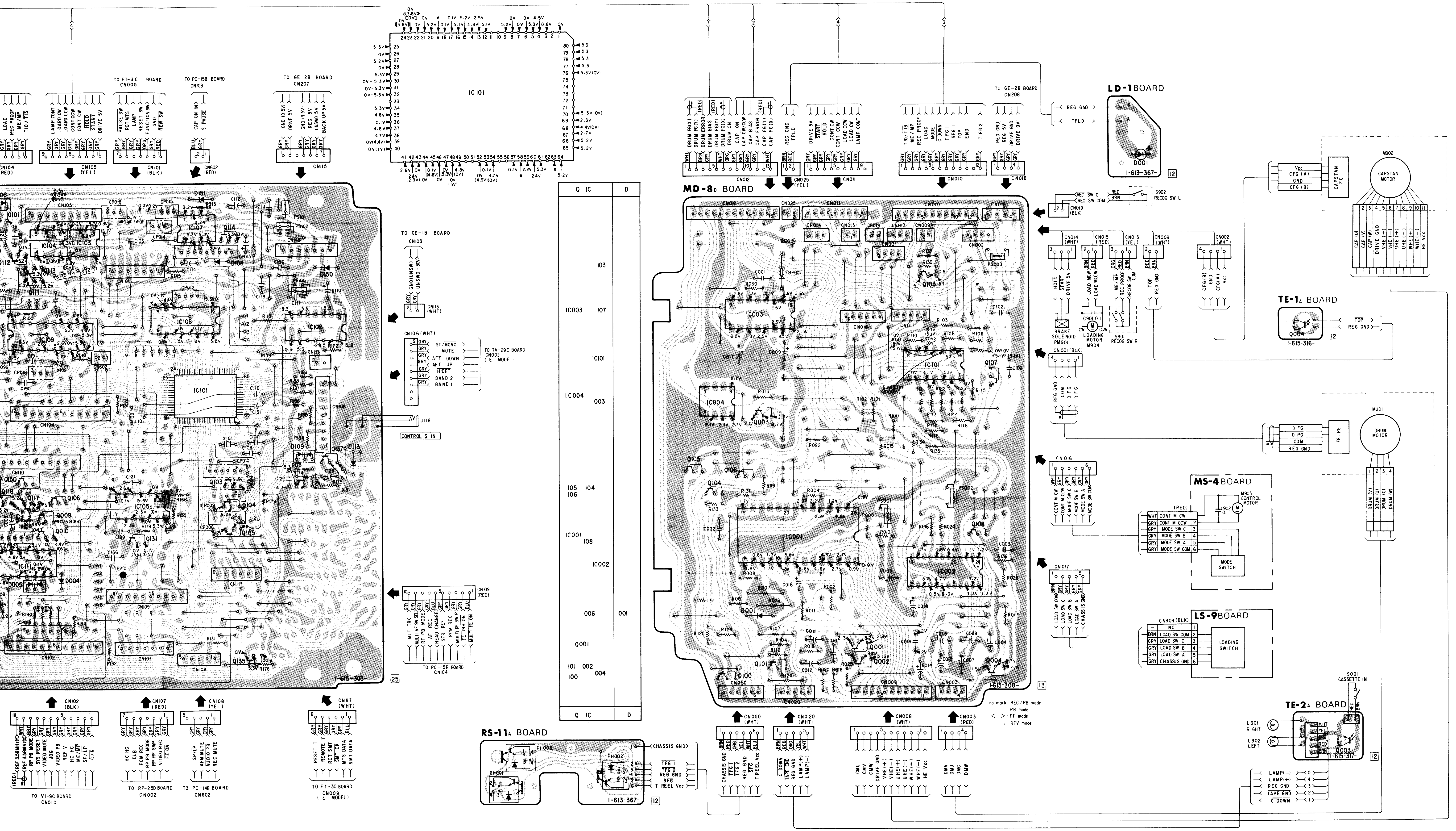
RS-11A BOARD



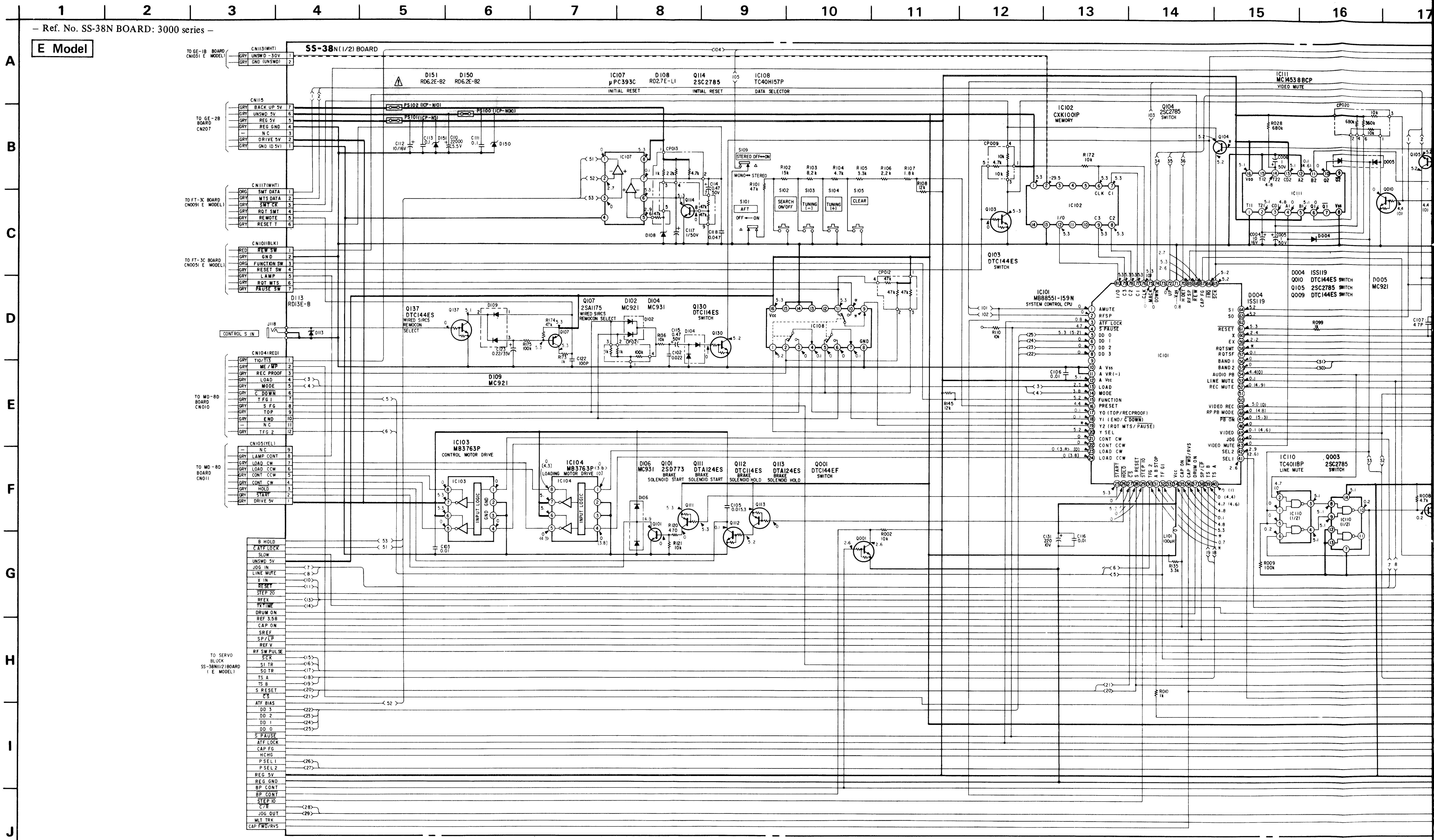
2A (TAPE-END SENSOR), MS-4 (MODE SWITCH/MODE CONTROL MOTOR DRIVE), LS-9 (LOADING SWITCH), LD-1 (TAPE SENSOR LIGHT EMISSION) PRINTED WIRING BOARD

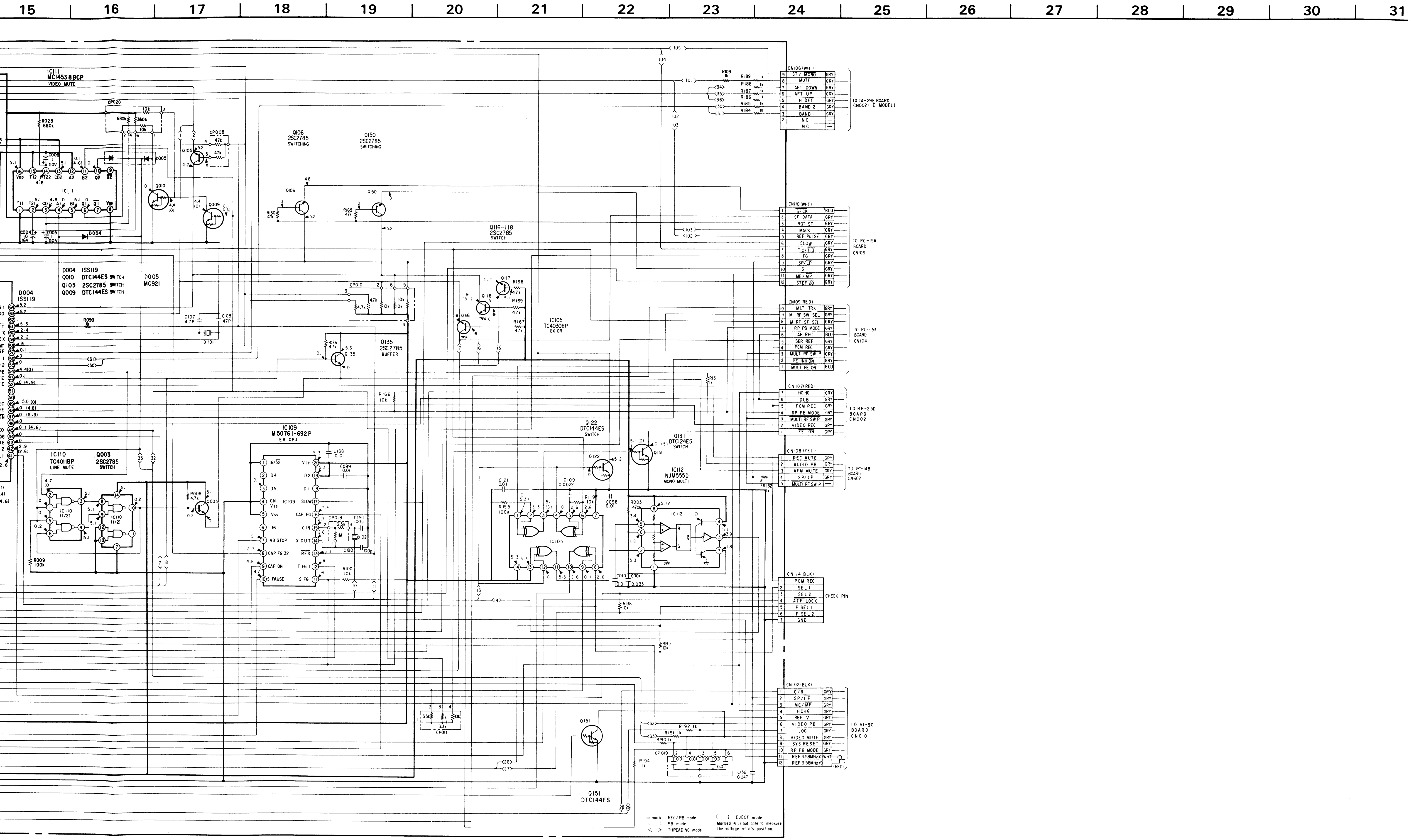
9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

ARD: 4600 series, TE-2A BOARD: 4800 series, MS-4 BOARD: 5000 series –



SS-38N (SYSTEM CONTROL/SERVO) SCHEMATIC DIAGRAM





IC111 MC14538BCP VIDEO MUTE
Q106 2SC2785 SWITCHING
Q150 2SC2785 SWITCHING
Q116-118 2SC2785 SWITCH
D004 ISS119
Q010 DTC144ES SWITCH
Q105 2SC2785 SWITCH
Q009 DTC144ES SWITCH
D005 MC921
IC105 TC4030BP EX OR
Q135 2SC2785 BUFFER
IC109 M50761-692P EM CPU
IC110 TC4011BP LINE MUTE
Q003 2SC2785 SWITCH
Q122 DTC144ES SWITCH
Q131 DTC124ES SWITCH
IC112 NJM555D MONO MULTI
Q151 DTC144ES
CN106(WHT)
ST/MONO
MUTE
AFT DOWN
AFT UP
H DET
BAND 2
BAND 1
NC
NC
TO TA-29E BOARD CN002 (E MODEL)
CN110(WHT)
SFCK
SF DATA
ROT SF
MACK
REF PULSE
SLOW
T10/T13
FG
SP/LP
SI
ME/MP
STEP 20
TO PC-158 BOARD CN106
CN109(RED)
MLT TRK
M RF SW SEL
M RF SP SEL
RP PB MODE
AF REC
SER REF
PCM REC
MULTI RF SW P
FE INH ON
MULTI FE ON
TO PC-158 BOARD CN104
CN107(RED)
HC HG
DUB
PCM REC
RP PB MODE
MULTI RF SW P
VIDEO REC
FE ON
TO RP-250 BOARD CN002
CN108(YEL)
REC MUTE
AUDIO PB
AFM MUTE
SP/LP
MULTI RF SW P
TO PC-148 BOARD CN602
CN114(BLK)
PCM REC
SEL 1
SEL 2
ATF LOCK
P SEL 1
P SEL 2
GND
CHECK PIN
CN102(BLK)
C/B
SP/LP
ME/MP
HCHG
REF V
VIDEO PB
JOG
VIDEO MUTE
SYS RESET
RP PB MODE
REF 3.58MHz(X)
REF 3.58MHz(Y)
TO VI-9C BOARD CN010
no mark REC/PB mode
( ) PB mode
< > THREADING mode
( ) EJECT mode
Marked # is not able to measure the voltage of it's position.

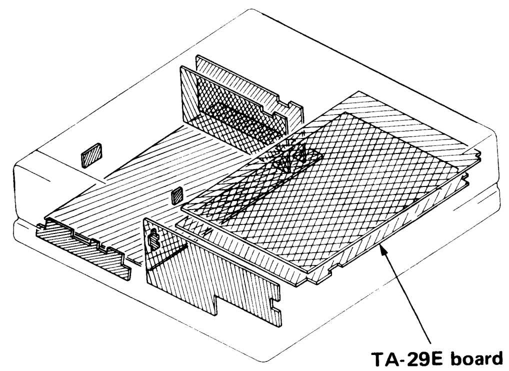
TA-29E (TUNER/VIF/MPX) PRINTED WIRING BOARD

– Ref. No. TA-29E BOARD: 6500 series –

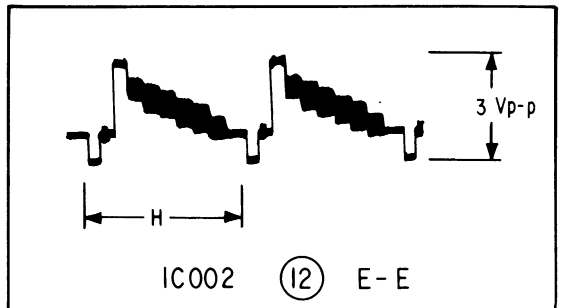
E Model

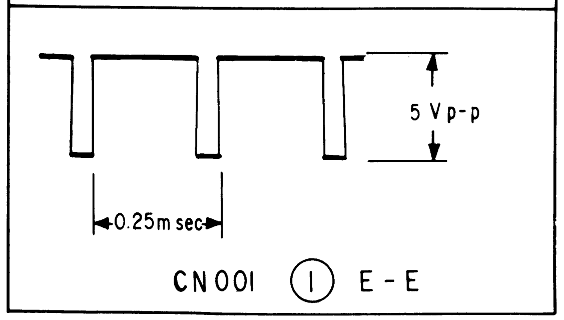
- ○— : parts extracted from the component side.
- ●— : parts extracted from the conductor side.
- ▒ : conductor side pattern.
- ░ : B + pattern.

- Digital transistor (TA-29E: Q015, 017) transistor with resistors. Refer to the TA-29E board schematic diagram for digital transistor.

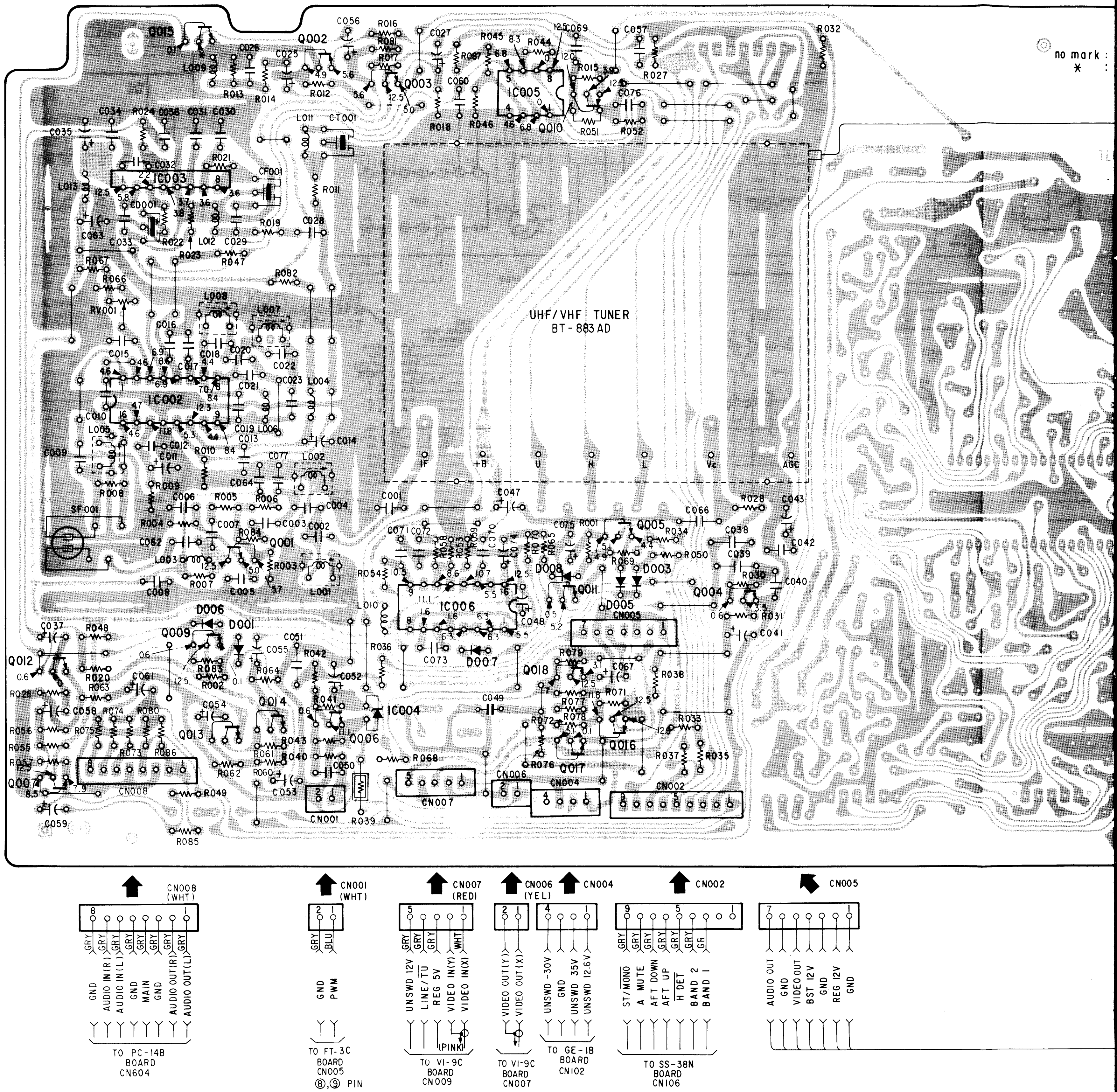


TA-29E BOARD





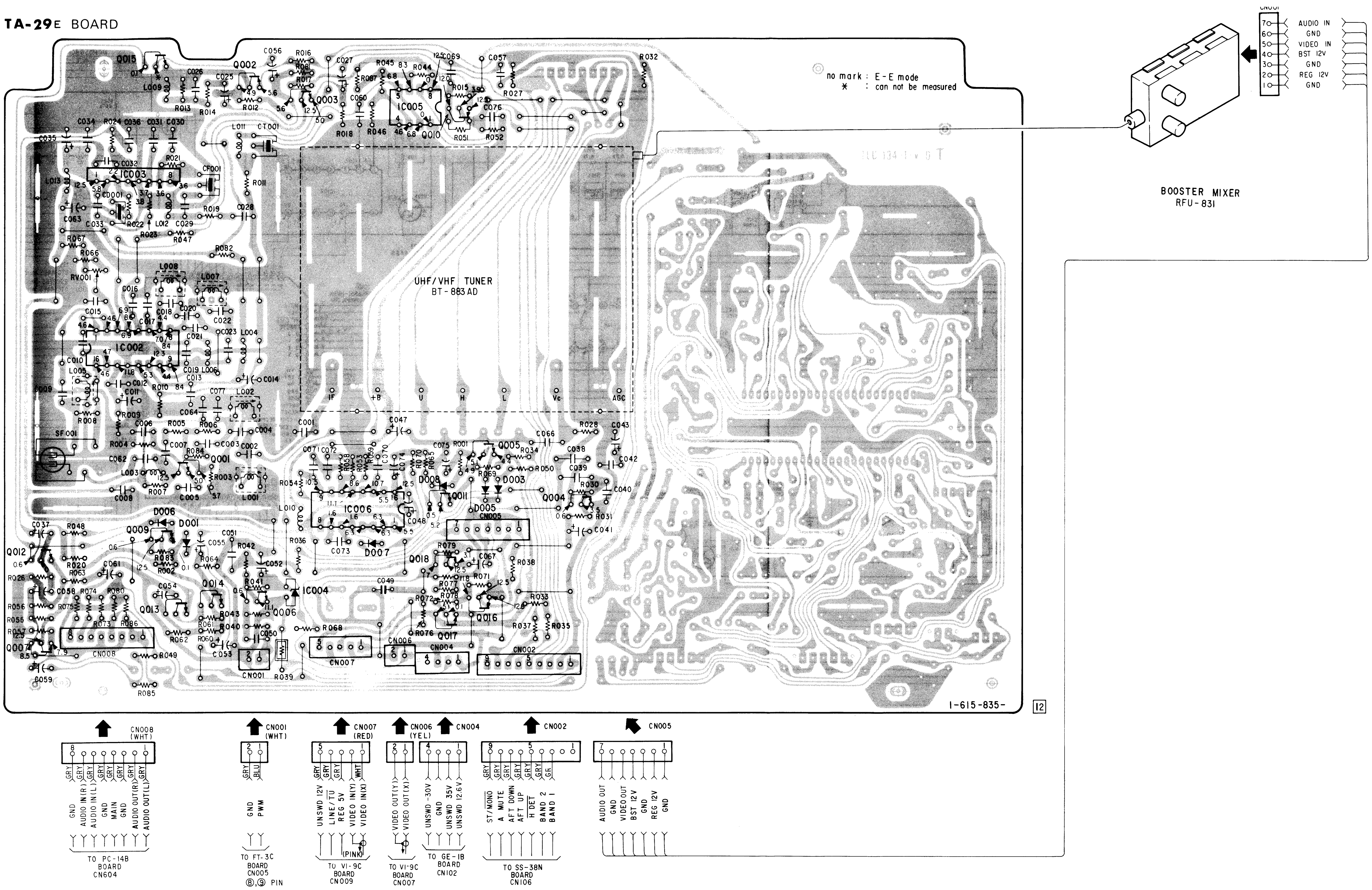
Q, IC	D	ADJ	TP
015 002			
003 IC005 010			
IC003			
		001	
IC002			
005 001 011 004 IC006	008 005 003		
009 012 018 IC004 013,014,006 016 017 007	006 001 007		
Q, IC	D	ADJ	TP



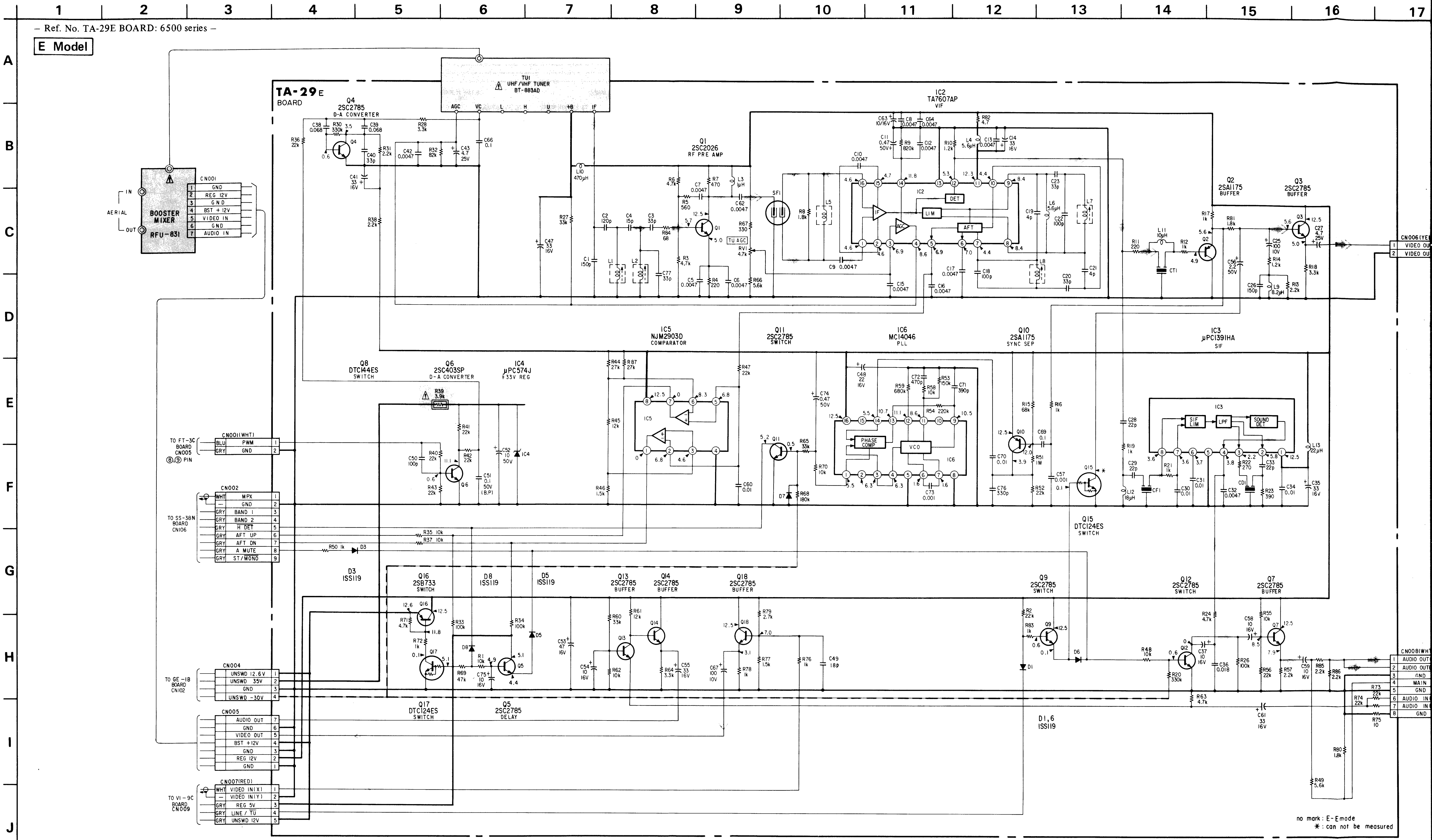
ING BOARD

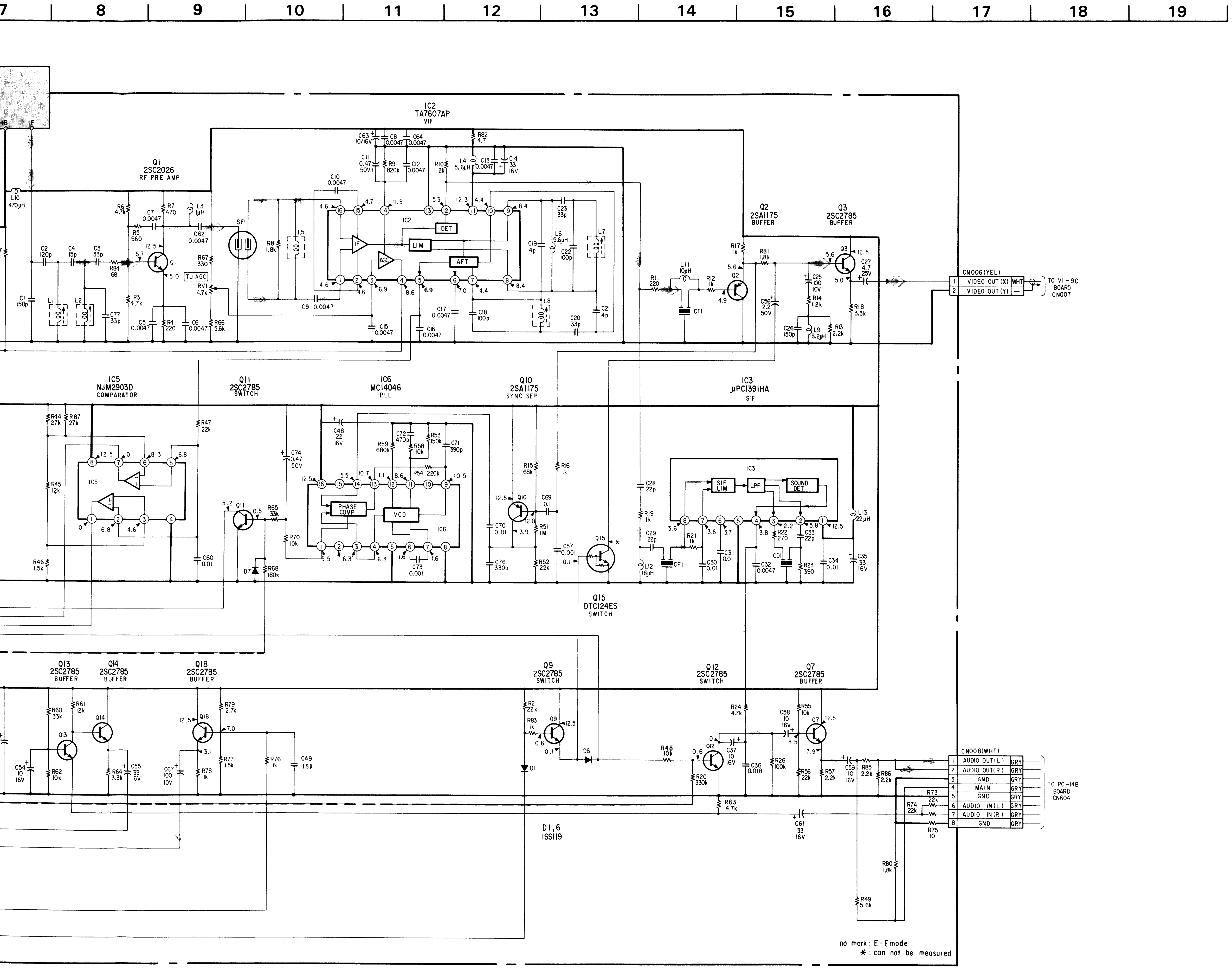
3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19

TA-29E BOARD



TA-29E (TUNER/VIF/MPX) SCHEMATIC DIAGRAM





- All capacitors are in μF unless otherwise noted, pF : μμF 50WV or less are not indicated except for electrolytics and tantalums.
- All resistors are in ohms, 1/6W unless otherwise noted. kΩ : 1000Ω, MΩ : 1000kΩ.
- All variable and semi-fixed resistors have characteristics curve B, unless otherwise noted.
- : nonfiammable resistor.
- : fusible resistor.
- : panel disignation.
- : adjustment for repair.
- : B + bus.
- : B − bus.
- The voltage value is a reference value between the grounding when the color bar signal is received from a color bar generator.
- All voltage are dc measured with a VOM (10MΩ)

Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

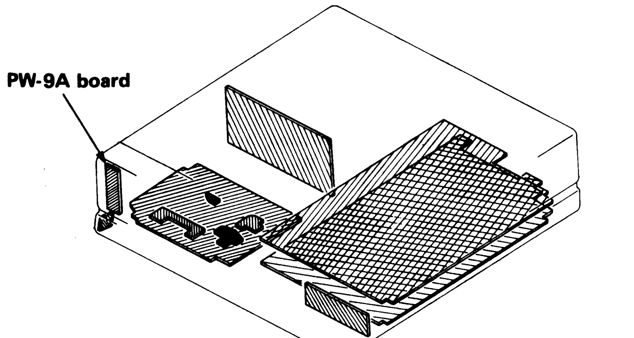
When indicating parts by reference number, please include the board name.

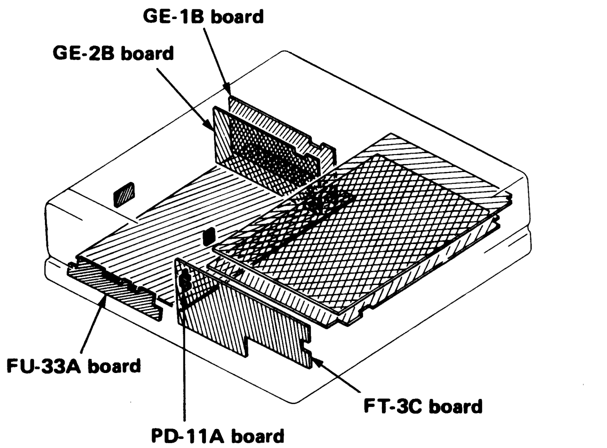
Signal path

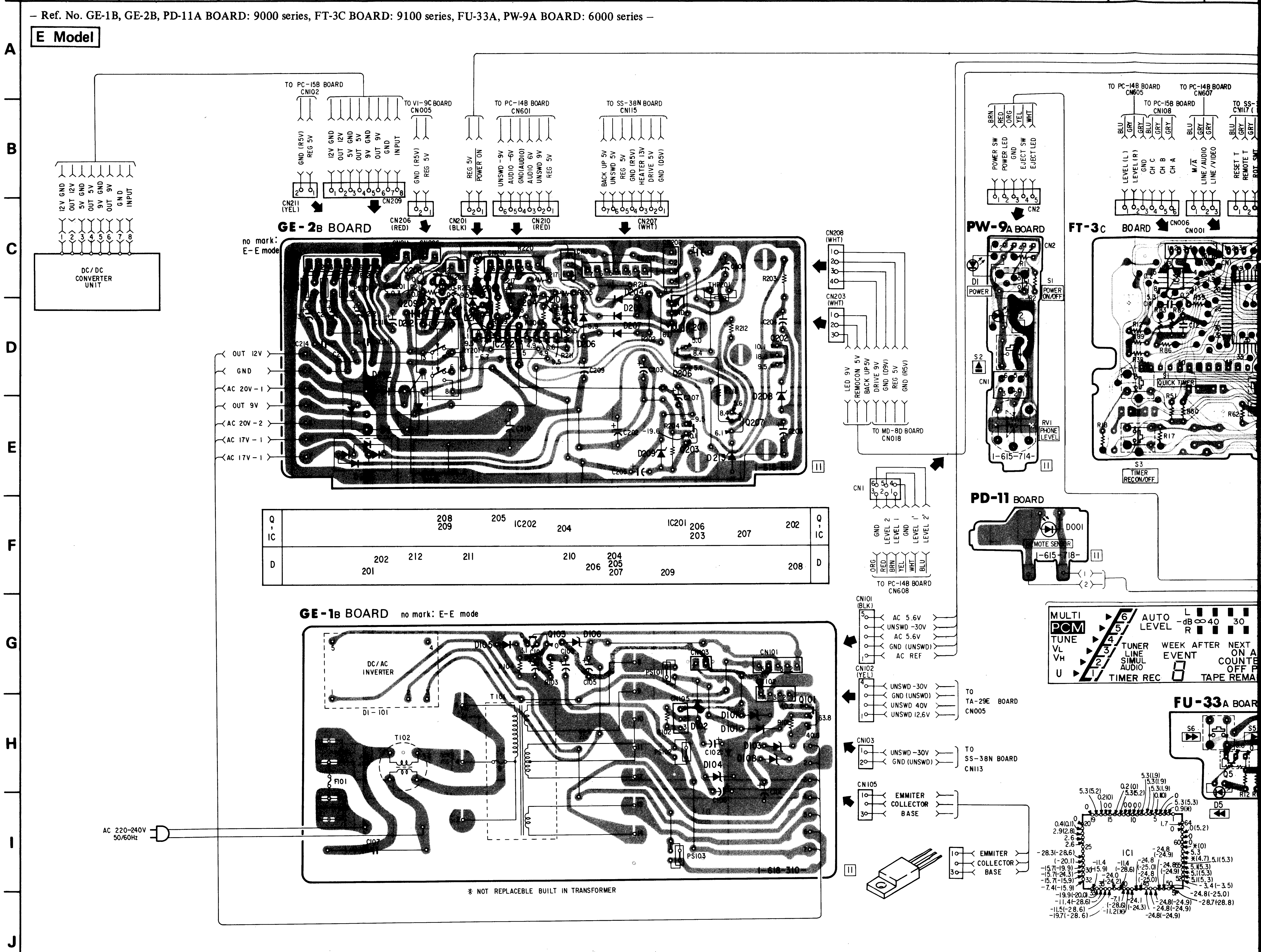
: REC Y/C Signal
: PB Y/C Signal

FT-3C (FUNCTION SWITCH/DISPLAY TUBE), GE-1B, GE-2B (POWER SUPPLY), FU-33A (FUNCTION SWITCH), PW-9A (POWER SWITCH/EJECTOR SWITCH), PD-11A (REMOTE CONTROL LIGHT RECE

- ○— : parts extracted from the component side.
- ●— : parts extracted from the conductor side.
- ▬ : conductor side pattern.
- ▬ : component side pattern.
- ▬ : B + pattern.
- ▬ : B − pattern.
- Digital transistor (FT-3D: Q006, GE-2B: Q211, 212) transistor with resistors. Refer to the FT-3D, GE-2B boards schematic diagram for digital transistor.



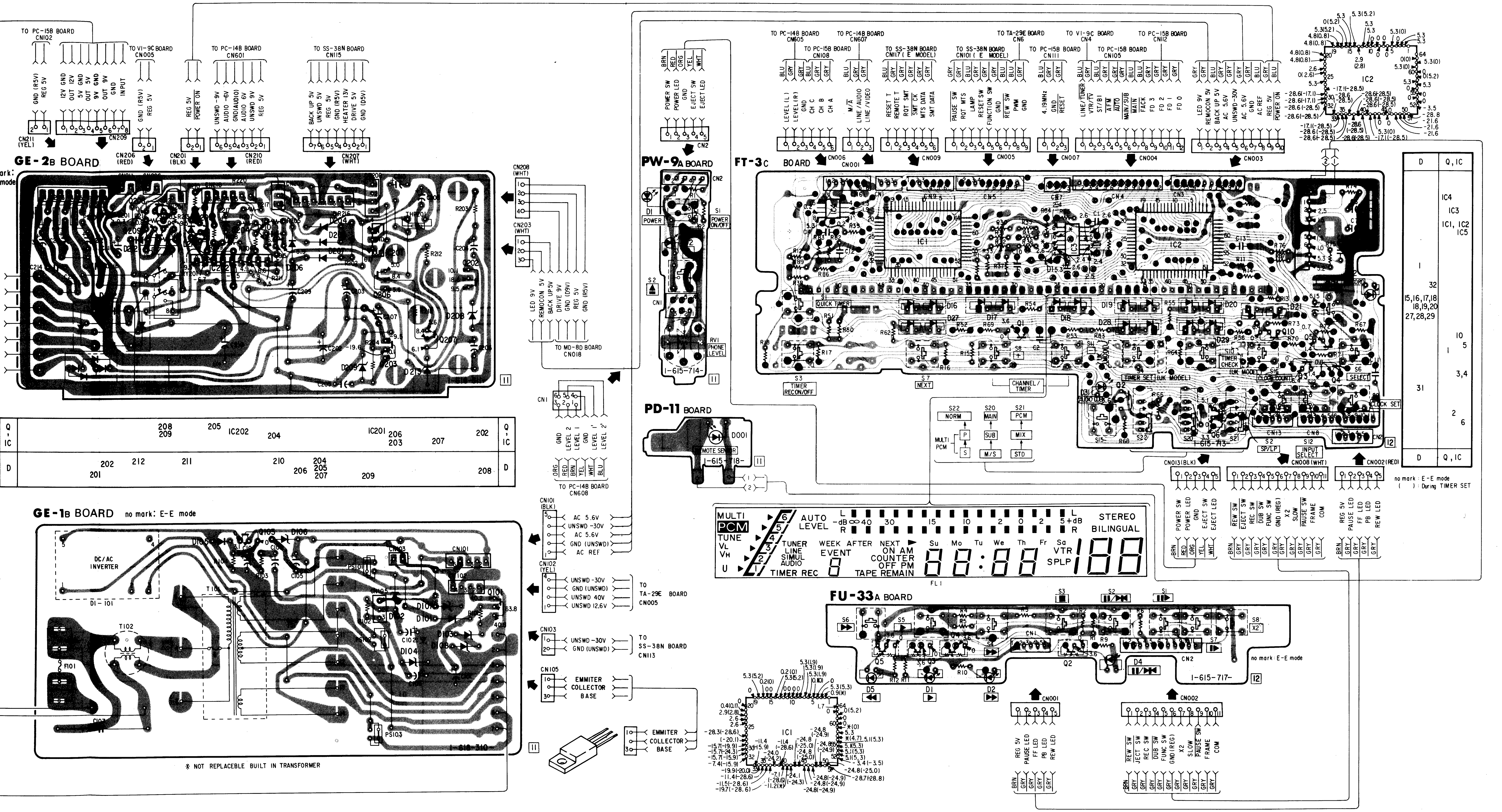




TUBE), GE-1B, GE-2B (POWER SUPPLY), FU-33A (FUNCTION SWITCH), PW-9A (POWER SWITCH/EJECTOR SWITCH), PD-11A (REMOTE CONTROL LIGHT RECEIVEING) PRINTED WIRING BOARD

3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19

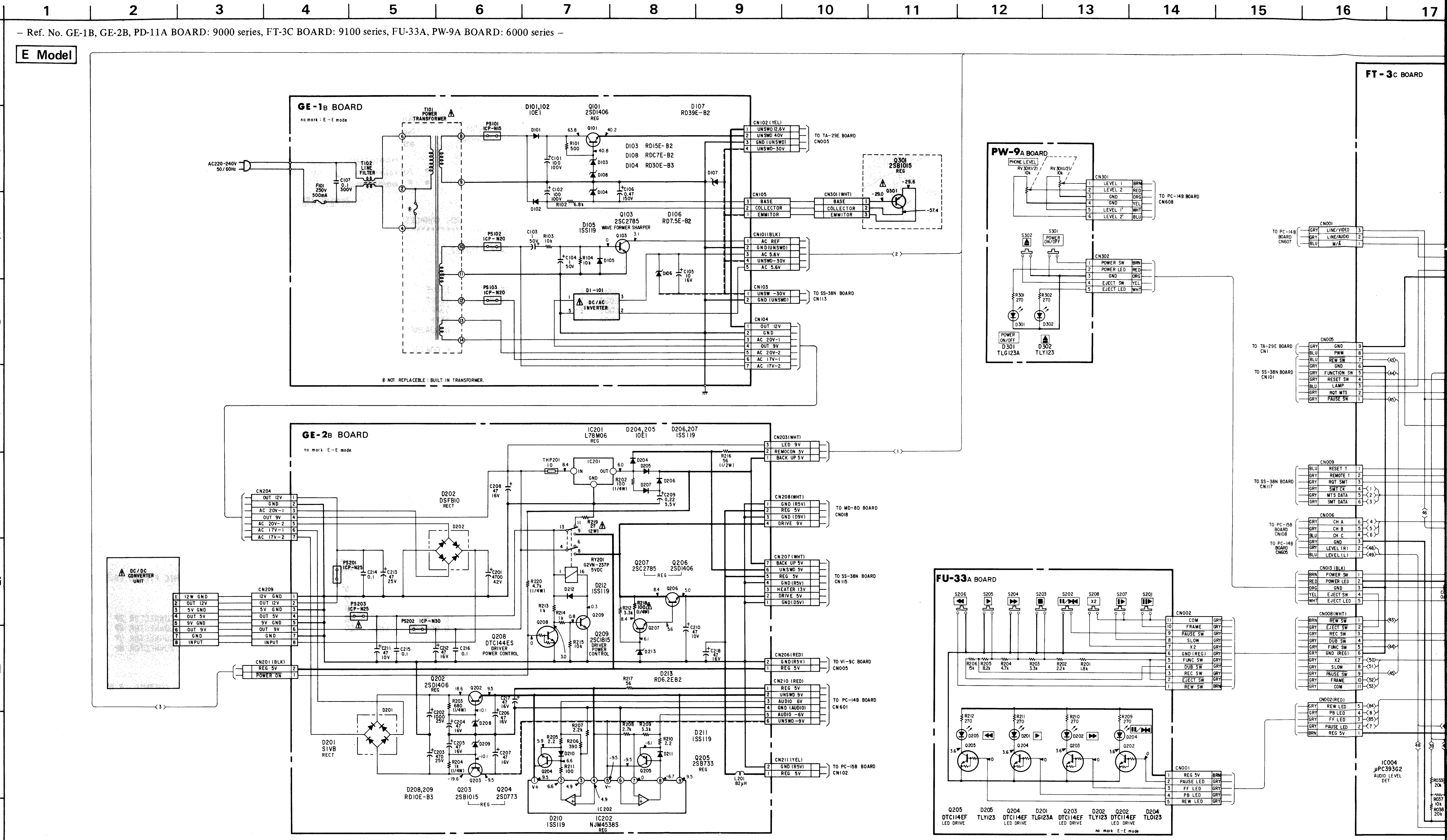
000 series, FT-3C BOARD: 9100 series, FU-33A, PW-9A BOARD: 6000 series –

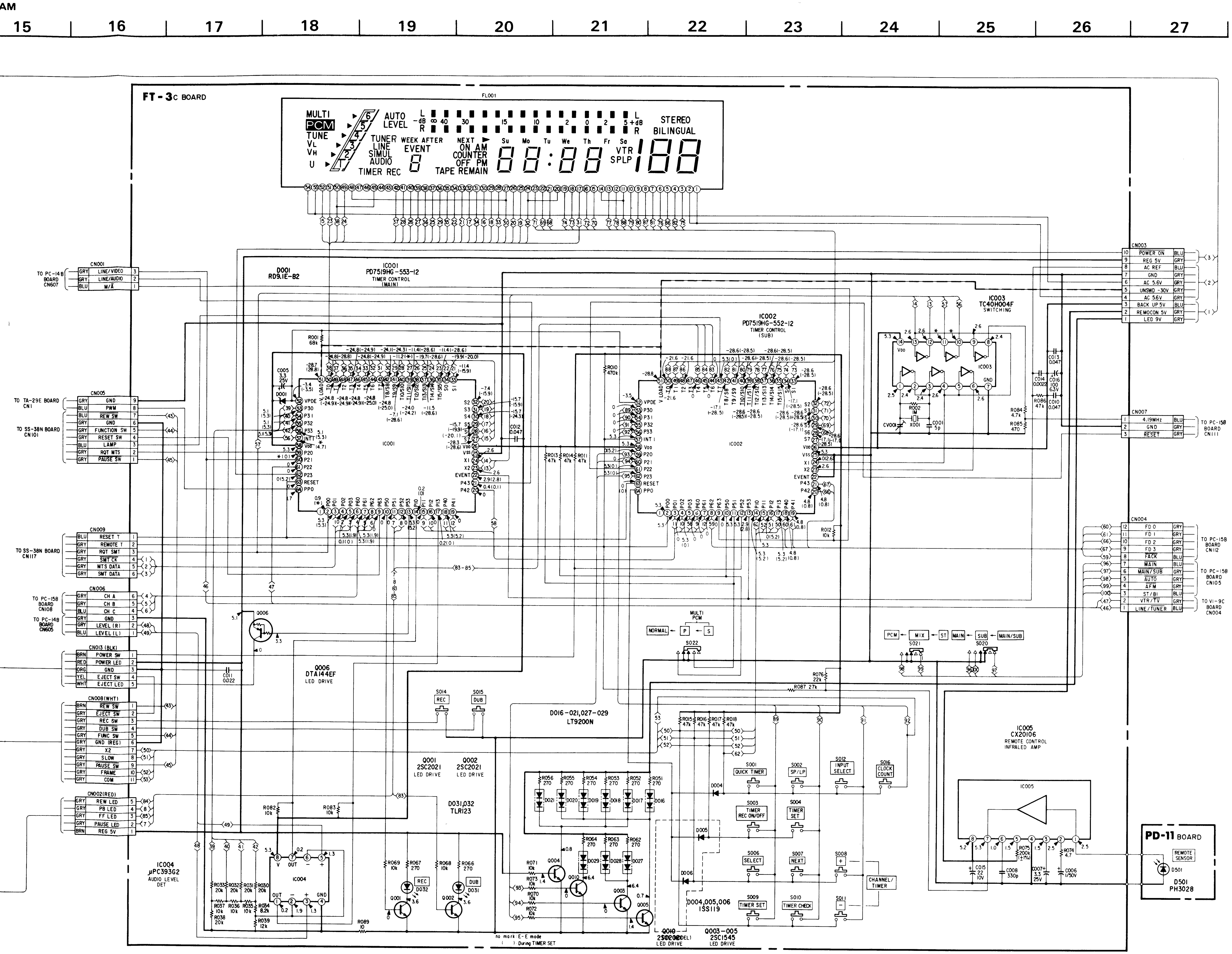


FT-3C (FUNCTION SWITCH/DISPLAY TUBE), GE-1B, GE-2B (POWER SUPPLY), FU-33A (FUNCTION SWITCH), PW-9A (POWER SWITCH/EJECTOR SWITCH), PD-11A (REMOTE CONTROL LIGHT RECEIVEING) SCHEMATIC DIAGRAM

– Ref. No. GE-1B, GE-2B, PD-11A BOARD: 9000 series, FT-3C BOARD: 9100 series, FU-33A, PW-9A BOARD: 6000 series –

E Model





- All capacitors are in μF unless otherwise noted, pF : $\mu\mu$F 50WV or less are not indicated except for electrolytics and tantalums.
- All resistors are in ohms, 1/6W unless otherwise noted. kΩ : 1000Ω, MΩ : 1000kΩ.
- All variable and semi-fixed resistors have characteristics curve B, unless otherwise noted.
- : nonfiammable resistor.
- : fusible resistor.
- : panel disignation.
- : B + bus.
- : B – bus.
- The voltage value is a reference value between the grounding when the color bar signal is received from a color bar generator.
- All voltage are dc measured with a VOM (10MΩ)

Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

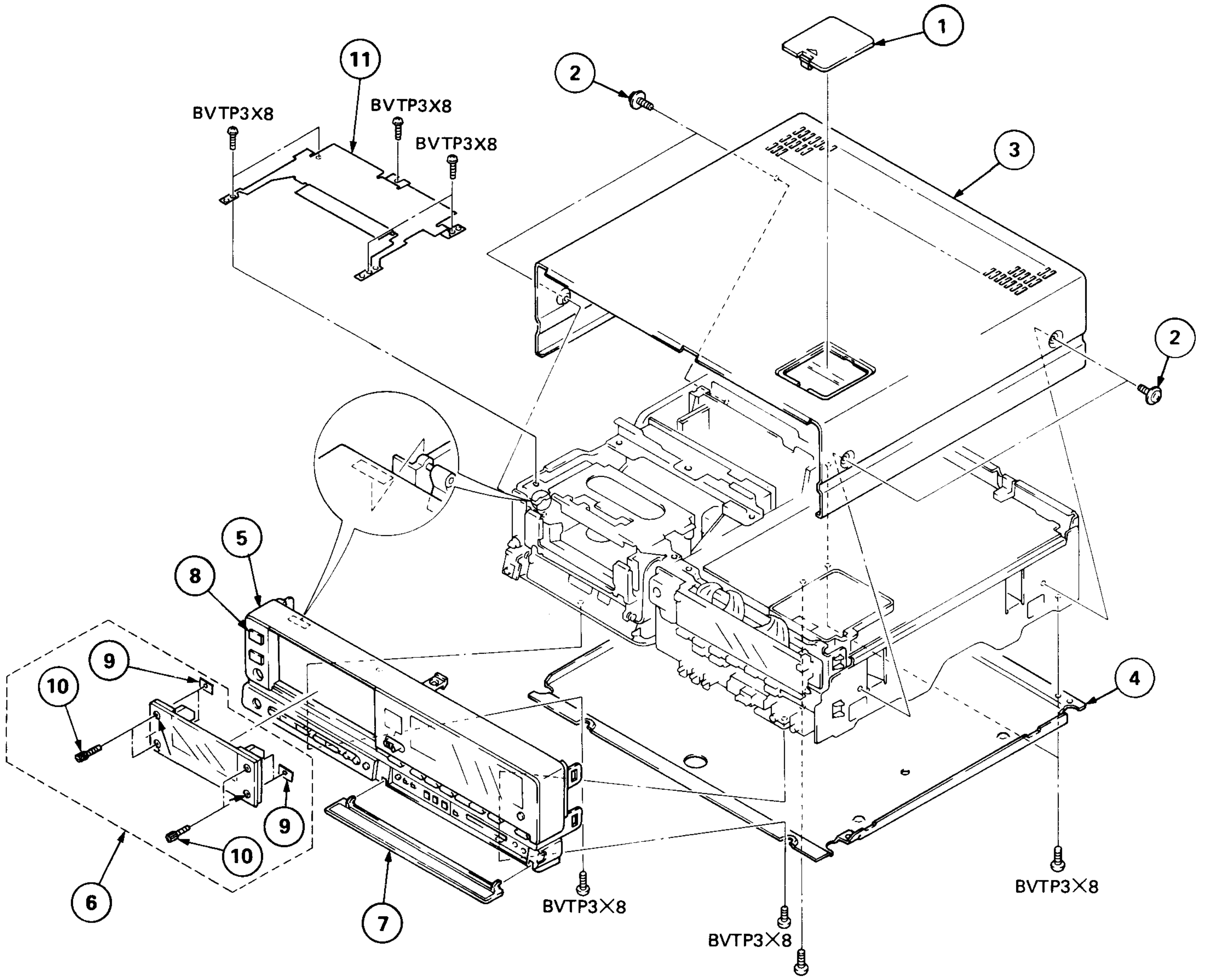
5. EXPLODED VIEWS

NOTE:

- Itmes with no part number and no description are not stocked because they are seldom required for routine service.
- The construction parts of an assembled part are indicated with a collation number in the remark column.
- Items marked "*" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.
- The mechanical parts with no reference number in the exploded views are not supplied.

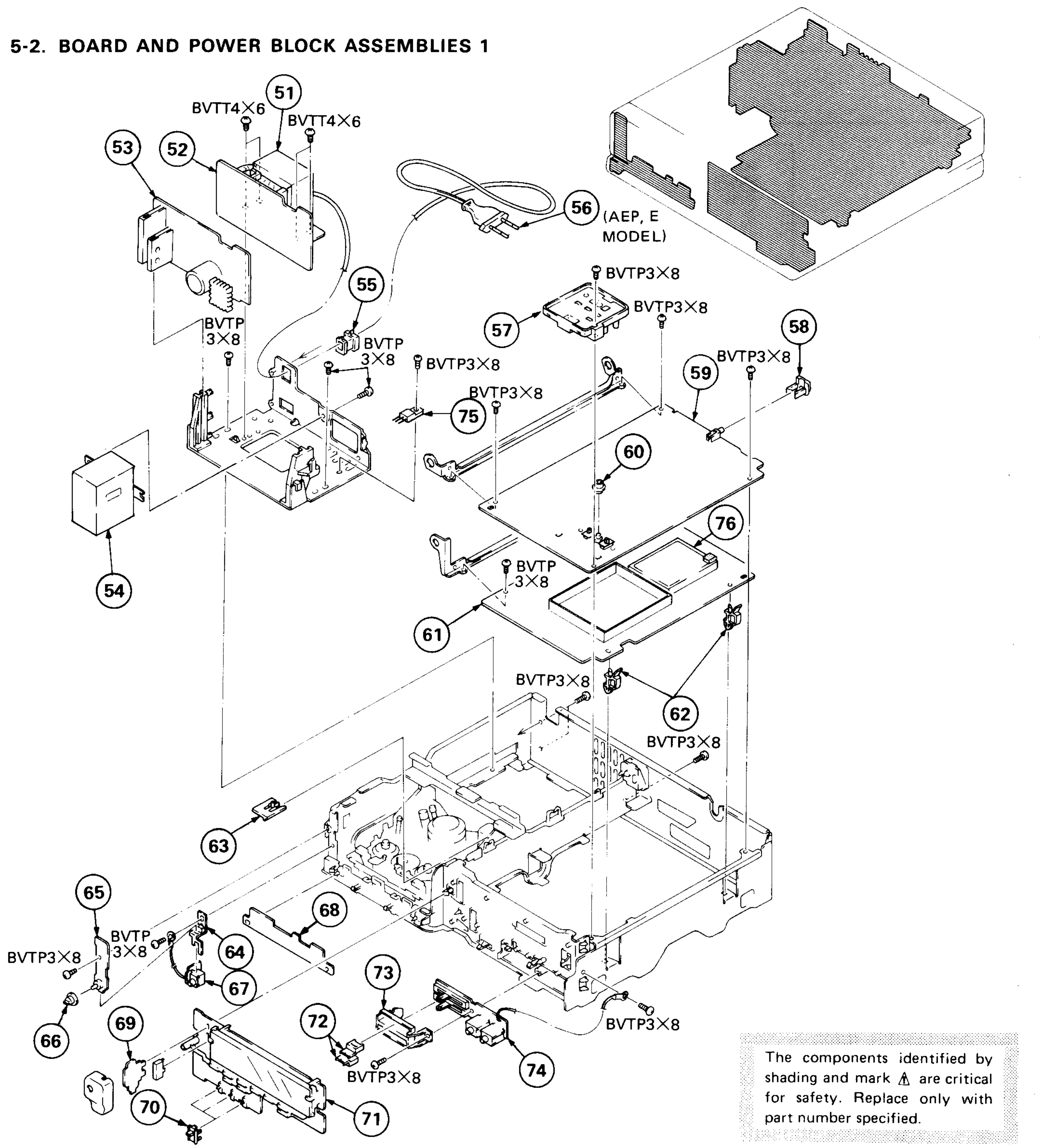
The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

5-1. FRONT PANEL AND CASE (UPPER, LOWER) ASSEMBLIES



No.	Part No.	Description	Remark
1	*2-352-647-01	LID, PRESET	
2	4-886-821-01	SCREW, M3 CASE	
3	X-3689-529-1	CASE ASSY, UPPER	
4	*3-691-907-03	PLATE, BUTTOM	
5	X-3689-523-1	FRONT ASSY (HA)	8
6	X-3689-505-4	LID (H) ASSY	9, 10
7	X-3689-558-1	DOOR ASSY (HEJ), FRONT (E MODEL)	
8	3-689-516-11	KEY, POWER	
9	3-689-040-1	NUT, PLATE	
10	3-689-039-01	SCREW (M2x5), SMALL	
11	*3-696-844-01	CASE, SHIELD (E MODEL)	

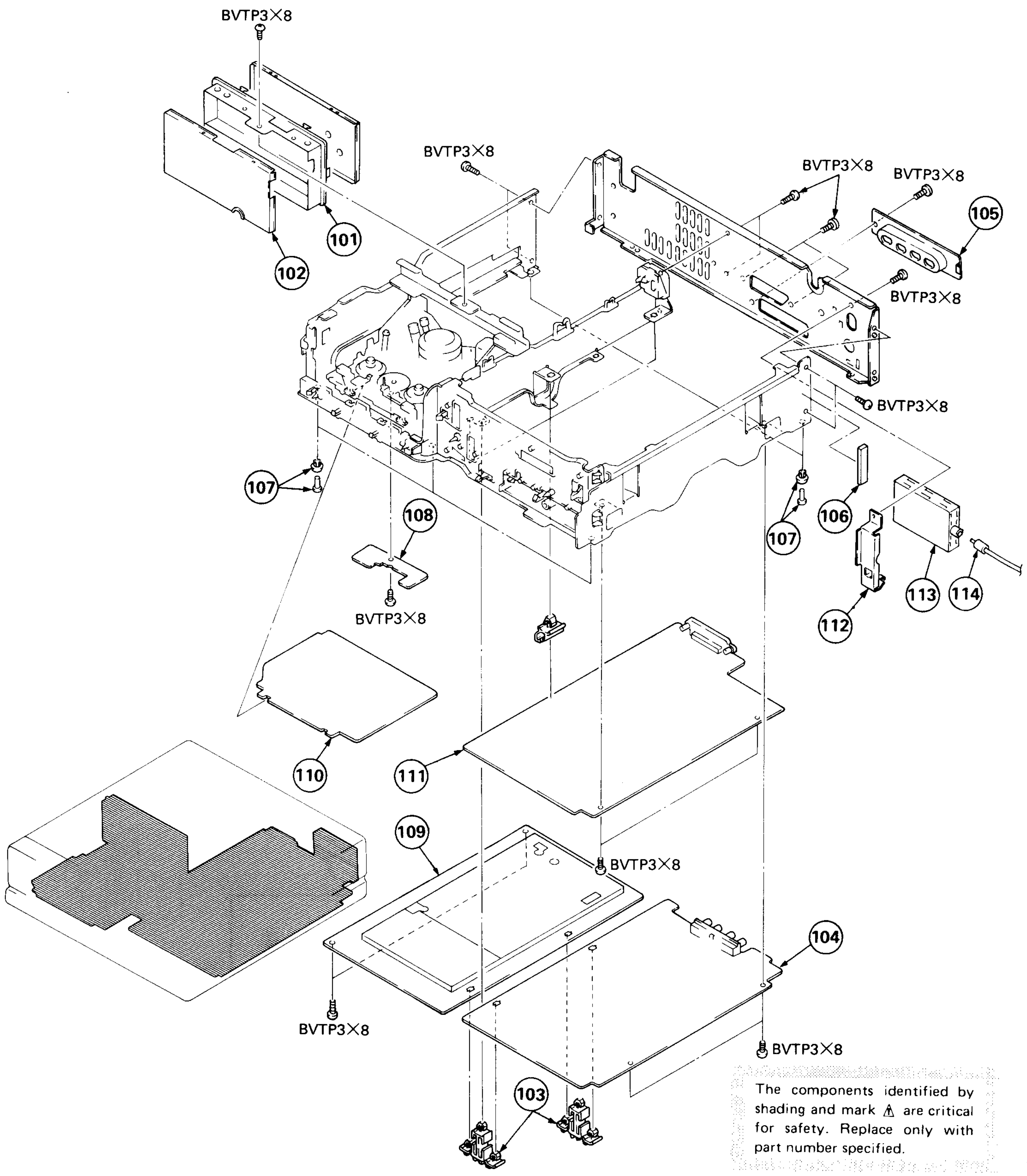
5-2. BOARD AND POWER BLOCK ASSEMBLIES 1



The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

No.	Part No.	Description	Remark
51	⚠1-448-439-11	TRANSFORMER, POWER T101 (E MODEL)	
52	*A-7070-220-A	GE-1B BOARD, MOUNTED (E MODEL)	
53	*A-7070-221-A	GE-2B BOARD, MOUNTED (E MODEL)	
54	⚠1-464-617-11	CONVERTER UNIT, DC-DC (E MODEL)	
55	⚠3-703-244-00	BUSHING (2104), CORD	
56	⚠1-534-817-XX	CORD, POWER (AEP, E MODEL)	
57	X-3689-023-2	KEYBOARD ASSY, PRESET (UK, E MODEL)	
58	3-691-912-01	PLATE, ORNAMENTAL, REMOTE	
59	*A-7060-359-A	SS-38N BOARD, COMPLETE (E MODEL)	
60	3-691-971-01	KNOB, SHARPNESS	
61	*A-7060-319-A	TA-29E BOARD, COMPLETE (E MODEL)	
62	3-682-047-01	HOLDER (A), PC BOARD	
63	*3-691-916-01	COVER, CAP	
64	*3-696-807-01	HOLDER, HP JACK	
65	*1-615-714-11	PW-9A BOARD	
66	X-3689-515-1	KNOB ASSY, HP	
67	A-7060-148-A	HP-11A BOARD, COMPLETE	
68	*1-615-717-11	FU-33 BOARD	
69	*1-615-718-11	PD-11A BOARD	
70	3-689-518-01	KEY, SLIDE	
71	*A-7060-158-A	FT-3C BOARD, COMPLETE (AEP, E MODEL)	
72	3-689-519-01	KEY, VOL	
73	*3-689-536-01	GUIDE, SLIDE	
74	*1-615-715-11	VJ-1 BOARD	
75	⚠8-729-202-02	TRANSISTOR 2SB1015-Y (E MODEL) Q301	
76	⚠1-463-577-31	TUNER, ET (BT-883AD) (AEP, E MODEL)	

5-3. BOARD ASSEMBLY 2



The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

No.	Part No.	Description	Remark
101	*A-7060-160-A	RP-25D BOARD, COMPLETE	
102	*3-689-066-01	LID, SHIELD CASE, RP	
103	*3-682-081-00	HOLDER, PCB	
104	*A-7060-154-A	PC-14B BOARD, COMPLETE	
105	3-689-580-01	PLATE (HA), ORNAMENTAL, JACK	
106	4-864-324-11	SPACER	
107	3-670-155-11	LEG	
108	*1-615-309-11	RS-11A BOARD	

No.	Part No.	Description	Remark
109	*A-7060-159-A	PC-15B BOARD, COMPLETE	
110	*A-7060-132-A	MD-8D BOARD, COMPLETE	
111	*A-7060-376-A	VI-9C BOARD, COMPLETE (E MODEL)	
112	*3-689-577-01	BRACKET (HA), ANTENNA	
113	⚠1-464-471-00	BOOSTER MIXER, RF MODULATOR RFU-831 (AEP, E MODEL)	
114	*1-555-110-00	CABLE PIN	

TA-29E

6. ELECTRICAL PARTS LIST

NOTE:

The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

- Due to standardization, replacements in the parts list may be different from the parts specified in the diagrams or the components used on the set.
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.

RESISTORS
- All resistors are in ohms
- F : nonflammable

- Items marked "*" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.

CAPACITORS
- MF : μF, PF : μμF

COILS
- MMH : mH, UH : μH

Ref.No	Part No.	Description			Remark
	*A-7060-319-A	TA-29E BOARD, COMPLETE (E MODEL)			
		************************			
	*4-336-029-00	PLATE, SHIELD			
		CAPACITOR			
C001	1-102-531-00	CERAMIC	150PF	5%	50V
C002	1-102-530-00	CERAMIC	120PF	5%	50V
C003	1-102-518-00	CERAMIC	33PF	5%	50V
C004	1-102-851-00	CERAMIC	15PF	5%	50V
C005	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C006	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C007	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C008	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C009	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C010	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C011	1-123-379-00	ELECT	0.47MF	20%	50V
C012	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C013	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C014	1-123-318-00	ELECT	33MF	20%	16V
C015	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C016	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C017	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C018	1-102-529-00	CERAMIC	100PF	5%	50V
C019	1-102-504-00	CERAMIC	4PF	0.25PF	50V
C020	1-102-518-00	CERAMIC	33PF	5%	50V
C021	1-102-504-00	CERAMIC	4PF	0.25PF	50V
C022	1-102-529-00	CERAMIC	100PF	5%	50V
C023	1-102-518-00	CERAMIC	33PF	5%	50V
C025	1-123-307-00	ELECT	100MF	20%	10V
C026	1-102-108-00	CERAMIC	150PF	10%	50V
C027	1-123-369-00	ELECT	4.7MF	20%	25V
C028	1-102-959-00	CERAMIC	22PF	5%	50V
C030	1-101-004-00	CERAMIC	0.01MF		50V
C031	1-101-004-00	CERAMIC	0.01MF		50V
C032	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C033	1-102-959-00	CERAMIC	22PF	5%	50V
C034	1-101-004-00	CERAMIC	0.01MF		50V
C035	1-123-318-00	ELECT	33MF	20%	16V
C036	1-108-807-00	MYLAR	0.018MF	5%	50V
C037	1-123-356-00	ELECT	10MF	20%	16V
C038	1-108-599-00	MYLAR	0.068MF	5%	50V
C039	1-108-599-00	MYLAR	0.068MF	5%	50V
C040	1-102-963-00	CERAMIC	33PF	5%	50V
C041	1-123-318-00	ELECT	33MF	20%	16V
C042	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C043	1-123-369-00	ELECT	4.7MF	20%	25V
C044	1-123-380-00	ELECT	1MF	20%	50V
C045	1-123-380-00	ELECT	1MF	20%	50V
C046	1-123-380-00	ELECT	1MF	20%	50V
C047	1-123-318-00	ELECT	33MF	20%	16V
C048	1-123-330-00	ELECT	22MF	20%	16V
C050	1-102-106-00	CERAMIC	100PF	10%	50V

Ref.No	Part No.	Description			Remark
C051	1-108-603-00	MYLAR	0.1MF	5%	50V
C052	1-123-369-00	ELECT	4.7MF	20%	50V
C053	1-123-319-51	ELECT	47MF	20%	16V
C054	1-123-356-00	ELECT	10MF	20%	16V
C055	1-123-318-00	ELECT	33MF	20%	16V
C056	1-123-381-00	ELECT	2.2MF	20%	50V
C057	1-102-074-00	CERAMIC	0.001MF	10%	50V
C058	1-123-356-00	ELECT	10MF	20%	16V
C059	1-123-356-00	ELECT	10MF	20%	16V
C060	1-101-004-00	CERAMIC	0.01MF		50V
C061	1-123-318-00	ELECT	33MF	20%	16V
C062	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C063	1-123-356-00	ELECT	10MF	20%	16V
C064	1-102-125-00	CERAMIC	0.0047MF	10%	50V
C066	1-108-603-00	MYLAR	0.1MF	5%	50V
C067	1-123-307-00	ELECT	100MF	20%	10V
C069	1-161-025-00	CERAMIC	0.1MF	10%	25V
C070	1-101-004-00	CERAMIC	0.01MF		50V
C071	1-102-113-00	CERAMIC	390PF	10%	50V
C072	1-102-114-00	CERAMIC	470PF	10%	50V
C073	1-106-172-00	MYLAR	0.001MF	5%	50V
C074	1-123-379-00	ELECT	0.47MF	20%	50V
C075	1-123-356-00	ELECT	10MF	20%	16V
C076	1-102-112-00	CERAMIC	330PF	10%	50V
C077	1-102-520-00	CERAMIC	39PF	5%	50V
		DISCRIMINATOR			
CD001	1-404-380-00	DISCRIMINATOR, CERAMIC 5.5MHZ			
		FILTER			
CF001	1-527-263-00	CERAMIC FILTER (5.5MHZ)			
		CONNECTOR			
CN001	*1-560-890-00	PIN, CONNECTOR 2P			
CN006	*1-560-890-00	PIN, CONNECTOR 2P			
CN007	*1-560-893-00	PIN, CONNECTOR 5P			
CN008	*1-560-896-00	PIN, CONNECTOR 8P			
		TRIMMER			
CT001	1-404-134-00	TRAP, CERAMIC (5.5MHZ)			
		DIODE			
D001	8-719-911-19	DIODE 1SS119			
D003	8-719-911-19	DIODE 1SS119			
D005	8-719-911-19	DIODE 1SS119			
D006	8-719-911-19	DIODE 1SS119			
D007	8-719-911-19	DIODE 1SS119			
D008	8-719-911-19	DIODE 1SS119			
		IC			
IC001	8-759-602-16	IC M54572L			
IC002	8-759-276-07	IC TA7607AP			

Ref.No	Part No.	Description	Remark
IC003	8-759-193-91	IC UPC1391H	
IC004	8-759-157-40	IC UPC574J	
IC005	8-759-729-03	IC NJM2903D	
IC006	8-759-040-46	IC MC14046BCP	

COIL

Ref.No	Part No.	Description	Remark
L001	1-404-476-00	COIL, IF	
L002	1-404-476-00	COIL, IF	
L003	1-408-591-00	MICRO INDUCTOR 1UH	
L004	1-408-406-00	MICRO INDUCTOR 5.6UH	
L005	1-404-522-11	VIFT	
L006	1-408-406-00	MICRO INDUCTOR 5.6UH	
L007	1-404-521-21	VIFT	
L008	1-404-521-21	VIFT	
L009	1-408-408-00	MICRO INDUCTOR 8.2UH	
L010	1-408-429-00	MICRO INDUCTOR 470UH	
L011	1-408-409-00	MICRO INDUCTOR 10UH	
L012	1-408-412-00	MICRO INDUCTOR 18UH	
L013	1-408-413-00	MICRO INDUCTOR 22UH	

TRANSISTOR

Ref.No	Part No.	Description	Remark
Q001	8-729-105-47	TRANSISTOR 2SC2026-L	
Q002	8-729-117-54	TRANSISTOR 2SA1175	
Q003	8-729-245-83	TRANSISTOR 2SC2458	
Q004	8-729-245-83	TRANSISTOR 2SC2458	
Q005	8-729-245-83	TRANSISTOR 2SC2458	
Q006	8-729-603-30	TRANSISTOR 2SC403SP-3	
Q007	8-729-245-83	TRANSISTOR 2SC2458	
Q008	8-729-900-89	TRANSISTOR DTC144ES	
Q009	8-729-245-83	TRANSISTOR 2SC2458	
Q010	8-729-117-54	TRANSISTOR 2SA1175	
Q011	8-729-245-83	TRANSISTOR 2SC2458	
Q012	8-729-245-83	TRANSISTOR 2SC2458	
Q013	8-729-245-83	TRANSISTOR 2SC2458	
Q014	8-729-245-83	TRANSISTOR 2SC2458	
Q015	8-729-900-36	TRANSISTOR DTC124ES	
Q016	8-729-113-32	TRANSISTOR 2SB733	
Q017	8-729-900-36	TRANSISTOR DTC124ES	
Q018	8-729-245-83	TRANSISTOR 2SC2458	

RESISTOR

Ref.No	Part No.	Description				Remark
R001	1-249-429-11	CARBON	10K	5%	1/6W	
R002	1-247-863-00	CARBON	22K	5%	1/6W	
R003	1-249-425-11	CARBON	4.7K	5%	1/6W	
R004	1-247-815-00	CARBON	220	5%	1/6W	
R005	1-249-414-11	CARBON	560	5%	1/6W	
R006	1-249-425-11	CARBON	4.7K	5%	1/6W	
R007	1-247-823-00	CARBON	470	5%	1/6W	
R008	1-247-837-00	CARBON	1.8K	5%	1/6W	
R009	1-247-901-00	CARBON	820K	5%	1/6W	
R010	1-247-833-00	CARBON	1.2K	5%	1/6W	
R011	1-247-815-00	CARBON	220	5%	1/6W	
R012	1-247-831-00	CARBON	1K	5%	1/6W	
R013	1-247-839-00	CARBON	2.2K	5%	1/6W	
R014	1-247-833-00	CARBON	1.2K	5%	1/6W	
R015	1-247-875-00	CARBON	68K	5%	1/6W	
R016	1-247-831-00	CARBON	1K	5%	1/6W	
R017	1-247-831-00	CARBON	1K	5%	1/6W	
R018	1-247-843-00	CARBON	3.3K	5%	1/6W	
R019	1-247-831-00	CARBON	1K	5%	1/6W	
R020	1-247-891-00	CARBON	330K	5%	1/6W	
R021	1-247-831-00	CARBON	1K	5%	1/6W	
R022	1-247-817-00	CARBON	270	5%	1/6W	
R023	1-247-821-00	CARBON	390	5%	1/6W	
R024	1-249-425-11	CARBON	4.7K	5%	1/6W	
R026	1-247-879-00	CARBON	100K	5%	1/6W	
R027	1-247-867-00	CARBON	33K	5%	1/6W	
R028	1-247-843-00	CARBON	3.3K	5%	1/6W	
R030	1-247-891-00	CARBON	330K	5%	1/6W	
R031	1-247-839-00	CARBON	2.2K	5%	1/6W	
R032	1-249-440-11	CARBON	82K	5%	1/6W	
R033	1-247-879-00	CARBON	100K	5%	1/6W	
R034	1-247-879-00	CARBON	100K	5%	1/6W	
R035	1-249-429-11	CARBON	10K	5%	1/6W	
R036	1-247-863-00	CARBON	22K	5%	1/6W	
R037	1-249-429-11	CARBON	10K	5%	1/6W	
R038	1-247-839-00	CARBON	2.2K	5%	1/6W	
R039 ⚠	1-247-720-11	CARBON	3.9K	5%	1/4W F	
R040	1-247-863-00	CARBON	22K	5%	1/6W	
R041	1-247-863-00	CARBON	22K	5%	1/6W	
R042	1-247-863-00	CARBON	22K	5%	1/6W	
R043	1-247-863-00	CARBON	22K	5%	1/6W	
R044	1-249-434-11	CARBON	27K	5%	1/6W	
R045	1-247-857-00	CARBON	12K	5%	1/6W	
R046	1-247-859-00	CARBON	15K	5%	1/6W	
R047	1-247-863-00	CARBON	22K	5%	1/6W	
R048	1-249-429-11	CARBON	10K	5%	1/6W	
R049	1-247-849-00	CARBON	5.6K	5%	1/6W	
R050	1-247-831-00	CARBON	1K	5%	1/6W	
R051	1-247-903-00	CARBON	1M	5%	1/6W	
R052	1-247-863-00	CARBON	22K	5%	1/6W	
R053	1-247-883-00	CARBON	150K	5%	1/6W	
R054	1-247-887-00	CARBON	220K	5%	1/6W	
R055	1-247-863-00	CARBON	22K	5%	1/6W	
R056	1-247-863-00	CARBON	22K	5%	1/6W	
R057	1-247-839-00	CARBON	2.2K	5%	1/6W	
R058	1-249-429-11	CARBON	10K	5%	1/6W	
R059	1-247-903-00	CARBON	1M	5%	1/6W	
R060	1-247-867-00	CARBON	33K	5%	1/6W	
R061	1-247-857-00	CARBON	12K	5%	1/6W	
R062	1-249-429-11	CARBON	10K	5%	1/6W	
R063	1-249-425-11	CARBON	4.7K	5%	1/6W	
R064	1-247-843-00	CARBON	3.3K	5%	1/6W	
R065	1-247-867-00	CARBON	33K	5%	1/6W	
R066	1-247-849-00	CARBON	5.6K	5%	1/6W	
R068	1-247-885-00	CARBON	180K	5%	1/6W	

The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

Ref.No	Part No.	Description	Remark
R069	1-249-437-11	CARBON 47K 5% 1/6W	
R070	1-249-429-11	CARBON 10K 5% 1/6W	
R071	1-249-425-11	CARBON 4.7K 5% 1/6W	
R072	1-247-831-00	CARBON 1K 5% 1/6W	
R073	1-247-863-00	CARBON 22K 5% 1/6W	
R074	1-247-863-00	CARBON 22K 5% 1/6W	
R075	1-247-783-00	CARBON 10 5% 1/6W	
R077	1-249-419-11	CARBON 1.5K 5% 1/6W	
R078	1-247-831-00	CARBON 1K 5% 1/6W	
R079	1-247-841-00	CARBON 2.7K 5% 1/6W	
R080	1-247-837-00	CARBON 1.8K 5% 1/6W	
R081	1-249-425-11	CARBON 4.7K 5% 1/6W	
R082	1-247-775-00	CARBON 4.7 5% 1/6W	
R083	1-247-831-00	CARBON 1K 5% 1/6W	
R084	1-247-803-00	CARBON 68 5% 1/6W	
R085	1-247-839-00	CARBON 2.2K 5% 1/6W	
R086	1-247-839-00	CARBON 2.2K 5% 1/6W	
R088	1-249-434-11	CARBON 27K 5% 1/6W	

VARIABLE RESISTOR

Ref.No	Part No.	Description	Remark
RV001	1-228-993-00	RES, ADJ, CARBON 4.7K	

SAWF

Ref.No	Part No.	Description	Remark
SF001	1-404-433-00	SAWF	

TUNER

Ref.No	Part No.	Description	Remark
TU001	⚠1-463-577-31	TUNER, ET (BT-883AD)	

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*1-618-310-11 GE-1B BOARD (E MODEL)
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Ref.No	Part No.	Description	Remark
	1-533-162-00	HOLDER, FUSE	
	*3-701-948-11	LABEL, FUSE	
	7-685-646-71	SCREW +BVTP 3X8 TYPE2 IT-3	
	7-685-646-81	SCREW +BVTP 3X8 TYPE2	

CAPACITOR

Ref.No	Part No.	Description	Remark
C101	1-123-605-00	ELECT 100MF 20% 100V	
C102	1-123-605-00	ELECT 100MF 20% 100V	
C103	1-123-380-00	ELECT 1MF 20% 50V	
C104	1-123-380-00	ELECT 1MF 20% 50V	
C105	1-123-356-00	ELECT 10MF 20% 16V	
C106	1-123-379-00	ELECT 0.47MF 20% 50V	
C107	⚠1-130-680-00	FILM 0.1MF 20% 300V	

CONNECTOR

Ref.No	Part No.	Description	Remark
CN101	*1-560-893-00	PIN, CONNECTOR 5P	
CN102	*1-560-892-00	PIN, CONNECTOR 4P	

DIODE

Ref.No	Part No.	Description	Remark
D101	8-719-200-02	DIODE 10E-2	
D102	8-719-200-02	DIODE 10E-2	
D103	8-719-100-71	DIODE RD15EB2	
D104	8-719-101-02	DIODE RD30EB4	
D105	8-719-911-19	DIODE 1SS119	
D106	8-719-100-44	DIODE RD7.5EB2	
D107	8-719-101-24	DIODE RD39EB2	
D108	8-719-100-94	DIODE RD27EB2	

INVERTER UNIT

Ref.No	Part No.	Description	Remark
DI101	⚠1-464-618-11	INVERTER UNIT, DC-AC	

FUSE

Ref.No	Part No.	Description	Remark
F101	⚠1-532-279-00	FUSE, TIME-LAG	

IC LINK

Ref.No	Part No.	Description	Remark
PS101	⚠1-532-679-00	LINK, IC ICP-N15	
PS102	⚠1-532-685-00	LINK, IC ICP-N20	
PS103	⚠1-532-685-00	LINK, IC ICP-N20	

TRANSISTOR

Ref.No	Part No.	Description	Remark
Q101	8-729-201-78	TRANSISTOR 2SD1406	
Q103	8-729-178-54	TRANSISTOR 2SC2785	

RESISTOR

Ref.No	Part No.	Description	Remark
R101	1-247-849-00	CARBON 5.6K 5% 1/6W	
R102	1-247-851-00	CARBON 6.8K 5% 1/6W	
R103	1-249-429-11	CARBON 10K 5% 1/6W	
R104	1-249-429-11	CARBON 10K 5% 1/6W	

TRANSFORMER

Ref.No	Part No.	Description	Remark
T102	⚠1-421-357-31	TRANSFORMER, LINE FILTER	

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*1-618-311-11 GE-2B BOARD (E MODEL)
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CAPACITOR

Ref.No	Part No.	Description	Remark
C201	1-125-437-11	ELECT(BLOCK) 8200MF 20% 35V	
C202	1-123-337-00	ELECT 1000MF 20% 25V	
C203	1-123-336-00	ELECT 470MF 20% 25V	
C204	1-123-319-51	ELECT 47MF 20% 16V	
C205	1-123-319-51	ELECT 47MF 20% 16V	
C206	1-123-319-51	ELECT 47MF 20% 16V	
C207	1-123-319-51	ELECT 47MF 20% 16V	
C208	1-123-319-51	ELECT 47MF 20% 16V	
C209	1-125-347-00	DOUBLE LAYERS 000002200R 5.5V	
C210	1-123-306-00	ELECT 47MF 20% 10V	
C211	1-123-306-00	ELECT 47MF 20% 10V	
C212	1-123-319-51	ELECT 47MF 20% 16V	
C213	1-123-332-00	ELECT 47MF 20% 25V	
C214	1-161-025-00	CERAMIC 0.1MF 10% 25V	
C215	1-161-025-00	CERAMIC 0.1MF 10% 25V	

The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

Ref.No	Part No.	Description				Remark
C216	1-161-025-00	CERAMIC	0.1MF	10%	25V	
C217	1-123-319-51	ELECT	47MF	20%	16V	
C218	1-123-319-51	ELECT	47MF	20%	16V	
		CONNECTOR				
CN201	*1-560-890-00	PIN, CONNECTOR 2P				
CN203	*1-560-891-00	PIN, CONNECTOR 3P				
CN206	*1-560-890-00	PIN, CONNECTOR 2P				
CN207	*1-560-895-00	PIN, CONNECTOR 7P				
CN208	*1-560-892-00	PIN, CONNECTOR 4P				
CN210	*1-560-894-00	PIN, CONNECTOR 6P				
CN211	*1-560-890-00	PIN, CONNECTOR 2P				
		DIODE				
D201	8-719-511-20	DIODE S1VB20				
D202	8-719-500-14	DIODE D5FB10F				
D204	8-719-200-02	DIODE 10E-2				
D205	8-719-200-02	DIODE 10E-2				
D206	8-719-911-19	DIODE 1SS119				
D207	8-719-911-19	DIODE 1SS119				
D208	8-719-100-58	DIODE RD10EB3				
D209	8-719-100-58	DIODE RD10EB3				
D210	8-719-911-19	DIODE 1SS119				
D211	8-719-911-19	DIODE 1SS119				
D212	8-719-911-19	DIODE 1SS119				
D213	8-719-100-38	DIODE RD6.2EB2				
		IC				
IC201	8-759-801-26	IC L78M06				
IC202	8-759-700-08	IC NJM4558S				
		COIL				
L201	1-408-420-00	MICRO INDUCTOR 82UH				
		IC LINK				
PS201⚠	1-532-637-00	LINK, IC ICP-N25				
PS202⚠	1-532-675-21	LINK, IC ICP-N38				
PS203⚠	1-532-637-00	LINK, IC ICP-N25				
PS204⚠	1-532-685-11	LINK, IC ICP-N20				
		TRANSISTOR				
Q202	8-729-201-78	TRANSISTOR 2SD1406				
Q203	8-729-202-02	TRANSISTOR 2SB1015				
Q204	8-729-177-33	TRANSISTOR 2SD773				
Q205	8-729-113-33	TRANSISTOR 2SB733				
Q206	8-729-201-78	TRANSISTOR 2SD1406				
Q207	8-729-178-54	TRANSISTOR 2SC2785				
Q208	8-729-900-89	TRANSISTOR DTC144ES				
Q209	8-729-281-53	TRANSISTOR 2SC1815-GR				
		RESISTOR				
R202	1-247-700-11	CARBON	100	5%	1/4W	

Ref.No	Part No.	Description				Remark
R203	1-247-711-11	CARBON	680	5%	1/4W	
R204	1-247-713-11	CARBON	1K	5%	1/4W	
R205	1-247-767-00	CARBON	2.2	5%	1/6W	
R206	1-247-821-00	CARBON	390	5%	1/6W	
R207	1-247-839-00	CARBON	2.2K	5%	1/6W	
R208	1-247-841-00	CARBON	2.7K	5%	1/6W	
R209	1-247-843-00	CARBON	3.3K	5%	1/6W	
R210	1-247-767-00	CARBON	2.2	5%	1/6W	
R211	1-247-807-00	CARBON	100	5%	1/6W	
R212	1-247-843-00	CARBON	3.3K	5%	1/6W	
R213	1-247-831-00	CARBON	1K	5%	1/6W	
R214	1-247-831-00	CARBON	1K	5%	1/6W	
R215	1-249-429-11	CARBON	10K	5%	1/6W	
R216	1-247-697-11	CARBON	56	5%	1/4W	
R217	1-247-801-00	CARBON	56	5%	1/6W	
R218 ⚠	1-206-473-00	METAL OXIDE	27	5%	2W	F
R219 ⚠	1-247-700-11	CARBON	100	5%	1/4W	
R220	1-249-425-11	CARBON	4.7K	5%	1/6W	
		RELAY				
RY201	1-515-464-00	RELAY				

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*A-7060-359-A SS-38N BOARD, COMPLETE (E MODEL)
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Ref.No	Part No.	Description			
		CAPACITOR			
C001	1-130-489-00	MYLAR	0.033MF	5%	50V
C004	1-123-356-00	ELECT	10MF	20%	16V
C005	1-123-380-00	ELECT	1MF	20%	50V
C006	1-123-380-00	ELECT	1MF	20%	50V
C010	1-162-300-00	CERAMIC	0.01MF	10%	25V
C098	1-162-306-31	CERAMIC	0.01MF	20%	16V
C099	1-162-306-31	CERAMIC	0.01MF	20%	16V
C102	1-161-055-00	CERAMIC	0.022MF	10%	25V
C103	1-162-300-00	CERAMIC	0.01MF	10%	25V
C105	1-162-300-00	CERAMIC	0.01MF	10%	25V
C106	1-162-300-00	CERAMIC	0.01MF	10%	25V
C107	1-101-880-00	CERAMIC	47PF	5%	50V
C108	1-101-880-00	CERAMIC	47PF	5%	50V
C109	1-161-043-00	CERAMIC	0.0022MF	10%	25V
C110	1-125-373-11	DOUBLE LAYERS	22000MF		5.5V
C111	1-161-025-00	CERAMIC	0.1MF	10%	25V
C112	1-123-356-00	ELECT	10MF	20%	16V
C113	1-161-025-00	CERAMIC	0.1MF	10%	25V
C114	1-123-379-00	ELECT	0.47MF	20%	50V
C115	1-123-379-00	ELECT	0.47MF	20%	50V
C116	1-161-013-00	CERAMIC	0.01MF	10%	25V
C117	1-123-380-00	ELECT	1MF	20%	50V
C118	1-161-059-00	CERAMIC	0.047MF	10%	25V
C121	1-162-300-00	CERAMIC	0.01MF	10%	25V
C122	1-102-973-00	CERAMIC	100PF	5%	50V

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When indicating parts by reference number, please include the board name.

SS-38N

Ref.No	Part No.	Description			Remark
C123	1-131-343-00	TANTALUM	0.22MF	20%	35V
C131	1-119-353-00	ELECT	220MF		10V
C136	1-161-059-00	CERAMIC	0.047MF	10%	25V
C138	1-162-300-00	CERAMIC	0.01MF	10%	25V
C190	1-102-973-00	CERAMIC	100PF	5%	50V
C191	1-102-973-00	CERAMIC	100PF	5%	50V
C201	1-130-481-00	MYLAR	0.0068MF	5%	50V
C202	1-124-271-00	ELECT	1MF	20%	50V
C203	1-102-973-00	CERAMIC	100PF	5%	50V
C209	1-162-300-00	CERAMIC	0.01MF	10%	25V
C218	1-123-356-00	ELECT	10MF	20%	16V
C219	1-123-608-00	ELECT	0.22MF	10%	50V
C220	1-161-047-00	CERAMIC	0.0047MF	10%	25V
C231	1-124-268-00	ELECT	0.22MF	20%	50V
C233	1-124-275-00	ELECT	2.2MF	20%	35V
C234	1-161-059-00	CERAMIC	0.047MF	10%	25V
C241	1-124-282-00	ELECT	22MF	20%	25V
C299	1-123-356-00	ELECT	10MF	20%	16V
C301	1-102-517-00	CERAMIC	30PF	5%	50V
C302	1-102-531-00	CERAMIC	150PF	5%	50V
C303	1-102-905-00	CERAMIC	130PF	5%	50V
C304	1-102-905-00	CERAMIC	130PF	5%	50V
C305	1-102-905-00	CERAMIC	130PF	5%	50V
C306	1-102-905-00	CERAMIC	130PF	5%	50V
C307	1-124-271-00	ELECT	1MF	20%	50V
C308	1-162-596-00	CERAMIC	0.022MF	10%	25V
C309	1-123-330-00	ELECT	22MF	20%	16V
C310	1-123-330-00	ELECT	22MF	20%	16V
C311	1-123-330-00	ELECT	22MF	20%	16V
C320	1-123-330-00	ELECT	22MF	20%	16V
C321	1-162-596-00	CERAMIC	0.022MF	10%	25V
C322	1-123-330-00	ELECT	22MF	20%	16V
C333	1-162-596-00	CERAMIC	0.022MF	10%	25V
C350	1-124-271-00	ELECT	1MF	20%	50V
C401	1-161-013-00	CERAMIC	0.01MF	10%	25V
C402	1-161-013-00	CERAMIC	0.01MF	10%	25V
C501	1-130-475-00	MYLAR	0.0022MF	5%	50V
C502	1-130-475-00	MYLAR	0.0022MF	5%	50V
C932	1-123-306-00	ELECT	47MF	20%	10V

CONNECTOR

Ref.No	Part No.	Description
CN101	*1-560-895-00	PIN, CONNECTOR 7P
CN102	*1-560-900-00	PIN, CONNECTOR 12P
CN103	*1-560-893-00	PIN, CONNECTOR 5P
CN105	*1-560-897-00	PIN, CONNECTOR 9P
CN106	*1-560-897-00	PIN, CONNECTOR 9P
CN107	*1-560-895-00	PIN, CONNECTOR 7P
CN108	*1-560-893-00	PIN, CONNECTOR 5P
CN109	*1-560-898-00	PIN, CONNECTOR 10P
CN110	*1-560-900-00	PIN, CONNECTOR 12P
CN113	*1-560-890-00	PIN, CONNECTOR 2P
CN114	*1-560-895-00	PIN, CONNECTOR 7P
CN117	*1-560-894-00	PIN, CONNECTOR 6P
CN201	*1-560-895-00	PIN, CONNECTOR 7P
CN202	*1-560-894-00	PIN, CONNECTOR 6P
CN301	*1-560-892-00	PIN, CONNECTOR 4P
CN601	*1-560-891-00	PIN, CONNECTOR 3P
CN602	*1-560-890-00	PIN, CONNECTOR 2P

COMPOSITION CIRCUIT BLOCK

Ref.No	Part No.	Description
CP008	1-232-789-11	COMPOSITION CIRCUIT BLOCK
CP009	1-232-787-11	COMPOSITION CIRCUIT BLOCK
CP010	1-232-790-11	COMPOSITION CIRCUIT BLOCK
CP011	1-232-845-11	COMPOSITION CIRCUIT BLOCK
CP012	1-232-786-11	COMPOSITION CIRCUIT BLOCK
CP013	1-232-851-11	COMPOSITION CIRCUIT BLOCK
CP018	1-232-841-11	COMPOSITION CIRCUIT BLOCK
CP020	1-232-852-11	COMPOSITION CIRCUIT BLOCK
CP021	1-232-846-12	COMPOSITION CIRCUIT BLOCK
CP022	1-232-842-11	COMPOSITION CIRCUIT BLOCK
CP023	1-232-924-11	COMPOSITION CIRCUIT BLOCK
CP024	1-232-842-11	COMPOSITION CIRCUIT BLOCK
CP028	1-232-923-11	COMPOSITION CIRCUIT BLOCK
CP029	1-232-844-11	COMPOSITION CIRCUIT BLOCK
CP030	1-232-782-11	COMPOSITION CIRCUIT BLOCK
CP031	1-232-925-11	COMPOSITION CIRCUIT BLOCK
CP032	1-232-930-11	COMPOSITION CIRCUIT BLOCK
CP033	1-232-926-11	COMPOSITION CIRCUIT BLOCK

DIODE

Ref.No	Part No.	Description
D004	8-719-911-19	DIODE 1SS119
D005	8-719-000-06	DIODE MC921
D102	8-719-000-06	DIODE MC921
D104	8-719-000-12	DIODE MC931
D106	8-719-000-12	DIODE MC931
D108	8-719-101-32	DIODE RD2.7EL1
D109	8-719-000-06	DIODE MC921
D113	8-719-113-07	DIODE RD13E-B
D150	8-719-100-38	DIODE RD6.2EB2
D151	8-719-100-38	DIODE RD6.2EB2
D204	8-719-000-12	DIODE MC931
D301	8-719-911-19	DIODE 1SS119
D302	8-719-911-19	DIODE 1SS119
D305	8-719-911-19	DIODE 1SS119
D306	8-719-911-19	DIODE 1SS119
D308	8-719-911-19	DIODE 1SS119
D309	8-719-911-19	DIODE 1SS119
D310	8-719-911-19	DIODE 1SS119
D311	8-719-911-19	DIODE 1SS119
D501	8-719-911-19	DIODE 1SS119
D502	8-719-911-19	DIODE 1SS119

FILTER

Ref.No	Part No.	Description
FL301	1-235-830-11	BPF
FL302	1-235-829-11	BPF

When indicating parts by reference number, please include the board name.

Ref.No	Part No.	Description	Remark
		IC	
IC101	8-759-913-87	IC MB88551-159N	
IC102	8-752-320-11	IC CXK1001P	
IC103	8-759-913-67	IC MB3763P	
IC104	8-759-913-67	IC MB3763P	
IC105	8-759-240-30	IC TC4030BP	
IC107	8-759-103-93	IC UPC393C	
IC108	8-759-200-07	IC TC40H157P	
IC109	8-759-602-64	IC M50761-692P	
IC110	8-759-240-11	IC TC4011BP	
IC111	8-759-045-38	IC MC14538BCP	
IC112	8-759-700-81	IC NJM555D	
IC201	8-752-013-50	IC CX20135	
IC202	8-759-200-56	IC TC4526BP	
IC203	8-759-135-80	IC UPC358C	
IC204	8-759-240-66	IC TC4066BP	
IC301	8-752-203-20	IC CX22032	
IC302	1-807-153-11	IC (DIFFERENTIAL DETECTOR) H8D1756	
IC303	8-759-602-76	IC M50763-633SP	
IC304	8-759-040-94	IC MC14094BCP	
IC305	8-759-200-07	IC TC40H157P	
IC306	8-759-240-53	IC TC4053BP	
IC401	8-759-135-80	IC UPC358C	
IC402	8-759-045-38	IC MC14538BCP	
IC404	8-759-240-66	IC TC4066BP	
IC501	8-759-045-38	IC MC14538BCP	
		JACK	
J118	1-507-562-00	JACK (CONTROL S IN)	
		COIL	
L101	1-407-169-XX	MICRO INDUCTOR 100UH	
L601	1-408-411-00	MICRO INDUCTOR 15UH	
L933	1-408-427-00	MICRO INDUCTOR 330UH	
		IC LINK	
PS100⚠	1-532-605-00	LINK, IC ICP-N10	
PS101⚠	1-532-727-11	LINK, IC ICP-N15	
PS102⚠	1-532-605-00	LINK, IC ICP-N10	
		TRANSISTOR	
Q001	8-729-900-33	TRANSISTOR DTC144EF	
Q003	8-729-245-83	TRANSISTOR 2SC2458	
Q009	8-729-900-89	TRANSISTOR DTC144ES	
Q010	8-729-900-89	TRANSISTOR DTC144ES	
Q101	8-729-177-32	TRANSISTOR 2SD773	
Q103	8-729-900-89	TRANSISTOR DTC144ES	
Q104	8-729-245-83	TRANSISTOR 2SC2458	
Q105	8-729-245-83	TRANSISTOR 2SC2458	
Q106	8-729-245-83	TRANSISTOR 2SC2458	
Q107	8-729-204-83	TRANSISTOR 2SA1048-GR	
Q111	8-729-900-63	TRANSISTOR DTA124ES	
Q112	8-729-900-80	TRANSISTOR DTC114ES	
Q113	8-729-900-63	TRANSISTOR DTA124ES	
Q114	8-729-245-83	TRANSISTOR 2SC2458	
Q116	8-729-245-83	TRANSISTOR 2SC2458	
Q117	8-729-245-83	TRANSISTOR 2SC2458	
Q118	8-729-245-83	TRANSISTOR 2SC2458	
Q122	8-729-900-89	TRANSISTOR DTC144ES	
Q130	8-729-900-80	TRANSISTOR DTC114ES	
Q131	8-729-900-36	TRANSISTOR DTC124ES	
Q135	8-729-245-83	TRANSISTOR 2SC2458	
Q137	8-729-900-89	TRANSISTOR DTC144ES	
Q150	8-729-245-83	TRANSISTOR 2SC2458	
Q151	8-729-900-89	TRANSISTOR DTC144ES	
Q201	8-729-245-83	TRANSISTOR 2SC2458	
Q202	8-729-245-83	TRANSISTOR 2SC2458	
Q203	8-729-204-83	TRANSISTOR 2SA1048-GR	
Q204	8-729-245-83	TRANSISTOR 2SC2458	
Q205	8-729-204-83	TRANSISTOR 2SA1048-GR	
Q206	8-729-204-83	TRANSISTOR 2SA1048-GR	
Q207	8-729-900-89	TRANSISTOR DTC144ES	
Q211	8-729-900-65	TRANSISTOR DTA144ES	
Q212	8-729-900-65	TRANSISTOR DTA144ES	
Q213	8-729-900-89	TRANSISTOR DTC144ES	
Q214	8-729-900-89	TRANSISTOR DTC144ES	
Q215	8-729-900-65	TRANSISTOR DTA144ES	
Q219	8-729-900-89	TRANSISTOR DTC144ES	
Q221	8-729-900-89	TRANSISTOR DTC144ES	
Q301	8-729-115-30	TRANSISTOR 2SK105A-30	
Q302	8-729-115-30	TRANSISTOR 2SK105A-30	
Q303	8-729-115-30	TRANSISTOR 2SK105A-30	
Q304	8-729-115-30	TRANSISTOR 2SK105A-30	
Q307	8-729-115-30	TRANSISTOR 2SK105A-30	
Q401	8-729-900-89	TRANSISTOR DTC144ES	
Q402	8-729-900-89	TRANSISTOR DTC144ES	
		RESISTOR	
R002	1-249-429-11	CARBON 10K 5% 1/6W	
R003	1-247-895-00	CARBON 470K 5% 1/6W	
R008	1-249-425-11	CARBON 4.7K 5% 1/6W	
R009	1-247-879-00	CARBON 100K 5% 1/6W	
R010	1-247-831-00	CARBON 1K 5% 1/6W	
R028	1-247-899-00	CARBON 680K 5% 1/6W	
R099	1-247-831-00	CARBON 1K 5% 1/6W	
R100	1-249-429-11	CARBON 10K 5% 1/6W	
R101	1-249-437-11	CARBON 47K 5% 1/6W	
R102	1-247-859-00	CARBON 15K 5% 1/6W	
R103	1-247-853-00	CARBON 8.2K 5% 1/6W	
R104	1-249-425-11	CARBON 4.7K 5% 1/6W	
R105	1-247-843-00	CARBON 3.3K 5% 1/6W	
R106	1-247-839-00	CARBON 2.2K 5% 1/6W	
R107	1-247-837-00	CARBON 1.8K 5% 1/6W	
R108	1-247-857-00	CARBON 12K 5% 1/6W	
R109	1-247-831-00	CARBON 1K 5% 1/6W	

The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

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Ref.No	Part No.	Description				Remark
R110	1-249-429-11	CARBON	10K	5%	1/6W	
R119	1-249-429-11	CARBON	10K	5%	1/6W	
R120	1-247-823-00	CARBON	470	5%	1/6W	
R121	1-249-429-11	CARBON	10K	5%	1/6W	
R130	1-249-437-11	CARBON	47K	5%	1/6W	
R131	1-247-831-00	CARBON	1K	5%	1/6W	
R132	1-247-831-00	CARBON	1K	5%	1/6W	
R135	1-247-843-00	CARBON	3.3K	5%	1/6W	
R136	1-249-429-11	CARBON	10K	5%	1/6W	
R138	1-249-429-11	CARBON	10K	5%	1/6W	
R139	1-249-429-11	CARBON	10K	5%	1/6W	
R145	1-247-857-00	CARBON	12K	5%	1/6W	
R155	1-247-879-00	CARBON	100K	5%	1/6W	
R165	1-249-437-11	CARBON	47K	5%	1/6W	
R166	1-249-429-11	CARBON	10K	5%	1/6W	
R167	1-249-437-11	CARBON	47K	5%	1/6W	
R168	1-249-437-11	CARBON	47K	5%	1/6W	
R169	1-249-437-11	CARBON	47K	5%	1/6W	
R172	1-249-429-11	CARBON	10K	5%	1/6W	
R173	1-247-831-00	CARBON	1K	5%	1/6W	
R174	1-249-437-11	CARBON	47K	5%	1/6W	
R175	1-247-879-00	CARBON	100K	5%	1/6W	
R176	1-249-425-11	CARBON	4.7K	5%	1/6W	
R184	1-247-831-00	CARBON	1K	5%	1/6W	
R185	1-247-831-00	CARBON	1K	5%	1/6W	
R186	1-247-831-00	CARBON	1K	5%	1/6W	
R187	1-247-831-00	CARBON	1K	5%	1/6W	
R188	1-247-831-00	CARBON	1K	5%	1/6W	
R189	1-247-831-00	CARBON	1K	5%	1/6W	
R190	1-247-831-00	CARBON	1K	5%	1/6W	
R191	1-247-831-00	CARBON	1K	5%	1/6W	
R192	1-247-831-00	CARBON	1K	5%	1/6W	
R194	1-247-831-00	CARBON	1K	5%	1/6W	
R202	1-247-843-00	CARBON	3.3K	5%	1/6W	
R203	1-249-434-11	CARBON	27K	5%	1/6W	
R206	1-247-853-00	CARBON	8.2K	5%	1/6W	
R207	1-247-849-00	CARBON	5.6K	5%	1/6W	
R208	1-247-849-00	CARBON	5.6K	5%	1/6W	
R209	1-247-863-00	CARBON	22K	5%	1/6W	
R210	1-247-873-00	CARBON	56K	5%	1/6W	
R211	1-247-869-00	CARBON	39K	5%	1/6W	
R212	1-247-867-00	CARBON	33K	5%	1/6W	
R213	1-247-843-00	CARBON	3.3K	5%	1/6W	
R214	1-249-432-11	CARBON	18K	5%	1/6W	
R231	1-247-867-00	CARBON	33K	5%	1/6W	
R232	1-247-869-00	CARBON	39K	5%	1/6W	
R235	1-249-434-11	CARBON	27K	5%	1/6W	
R236	1-247-879-00	CARBON	100K	5%	1/6W	
R242	1-247-879-00	CARBON	100K	5%	1/6W	
R243	1-249-429-11	CARBON	10K	5%	1/6W	
R246	1-249-437-11	CARBON	47K	5%	1/6W	
R260	1-249-429-11	CARBON	10K	5%	1/6W	
R272	1-249-437-11	CARBON	47K	5%	1/6W	
R275	1-249-429-11	CARBON	10K	5%	1/6W	
R280	1-247-849-00	CARBON	5.6K	5%	1/6W	
R284	1-249-425-11	CARBON	4.7K	5%	1/6W	
R285	1-247-899-00	CARBON	680K	5%	1/6W	
R286	1-249-437-11	CARBON	47K	5%	1/6W	
R294	1-247-845-00	CARBON	3.9K	5%	1/6W	
R295	1-247-859-00	CARBON	15K	5%	1/6W	
R301	1-249-437-11	CARBON	47K	5%	1/6W	
R302	1-249-437-11	CARBON	47K	5%	1/6W	
R303	1-249-437-11	CARBON	47K	5%	1/6W	
R304	1-249-437-11	CARBON	47K	5%	1/6W	
R307	1-249-429-11	CARBON	10K	5%	1/6W	
R310	1-247-879-00	CARBON	100K	5%	1/6W	
R311	1-247-879-00	CARBON	100K	5%	1/6W	
R312	1-249-429-11	CARBON	10K	5%	1/6W	
R313	1-247-873-00	CARBON	56K	5%	1/6W	
R318	1-247-863-00	CARBON	22K	5%	1/6W	
R319	1-247-857-00	CARBON	12K	5%	1/6W	
R327	1-247-887-00	CARBON	220K	5%	1/6W	
R328	1-247-867-00	CARBON	33K	5%	1/6W	
R329	1-247-891-00	CARBON	330K	5%	1/6W	
R350	1-247-879-00	CARBON	100K	5%	1/6W	
R351	1-247-863-00	CARBON	22K	5%	1/6W	
R404	1-249-437-11	CARBON	47K	5%	1/6W	
R408	1-249-437-11	CARBON	47K	5%	1/6W	
R409	1-247-893-00	CARBON	390K	5%	1/6W	
R410	1-247-895-00	CARBON	470K	5%	1/6W	
R501	1-247-863-00	CARBON	22K	5%	1/6W	
R502	1-249-429-11	CARBON	10K	5%	1/6W	
R503	1-247-881-00	CARBON	120K	5%	1/6W	
R504	1-247-831-00	CARBON	1K	5%	1/6W	
R604	1-247-807-00	CARBON	100	5%	1/6W	

VARIABLE RESISTOR

RV201	1-228-995-00	RES, ADJ, CARBON 22K	
RV202	1-228-995-00	RES, ADJ, CARBON 22K	
RV203	1-228-998-00	RES, ADJ, METAL GLAZE 220K	
RV301	1-228-998-00	RES, ADJ, METAL GLAZE 220K	
RV401	1-228-997-00	RES, ADJ, CARBON 100K	
RV402	1-228-997-00	RES, ADJ, CARBON 100K	
RV501	1-228-997-00	RES, ADJ, METAL GLAZE 100K	
RV601	1-230-660-11	RES, VAR, CARBON 1K	

SWITCH

S101	1-570-157-11	SWITCH, SLIDE	
S102	1-554-174-00	SWITCH, KEY BOARD	
S103	1-554-174-00	SWITCH, KEY BOARD	
S104	1-554-174-00	SWITCH, KEY BOARD	
S105	1-554-174-00	SWITCH, KEY BOARD	

CRYSTAL

X101	1-567-346-11	OSCILLATOR, CERAMIC	

When indicating parts by reference number, please include the board name.

Ref.No	Part No.	Description			Remark
X102	1-527-965-00	OSCILLATOR, CERAMIC			

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*A-7060-376-A VI-9C BOARD, COMPLETE (E MODEL)
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Ref.No	Part No.	Description			Remark
	1-562-838-21	JACK, PIN 4P			
	*1-617-208-11	SK-9 BOARD			

CAPACITOR

Ref.No	Part No.	Description			Remark
C001	1-161-025-00	CERAMIC	0.1MF	10%	25V
C002	1-102-824-00	CERAMIC	470PF	5%	50V
C003	1-101-006-21	CERAMIC	0.047MF		50V
C004	1-161-025-00	CERAMIC	0.1MF	10%	25V
C006	1-102-116-00	CERAMIC	680PF	10%	50V
C007	1-101-006-21	CERAMIC	0.047MF		50V
C008	1-123-356-00	ELECT	10MF	20%	16V
C009	1-123-356-00	ELECT	10MF	20%	16V
C010	1-123-356-00	ELECT	10MF	20%	16V
C011	1-101-006-21	CERAMIC	0.047MF		50V
C012	1-101-006-21	CERAMIC	0.047MF		50V
C013	1-123-380-00	ELECT	1MF	20%	50V
C014	1-123-309-00	ELECT	330MF	20%	6.3V
C015	1-124-471-00	ELECT	1000MF	20%	6.3V
C016	1-123-369-00	ELECT	4.7MF	20%	25V
C017	1-123-369-00	ELECT	4.7MF	20%	25V
C019	1-123-356-00	ELECT	10MF	20%	16V
C020	1-101-006-21	CERAMIC	0.047MF		50V
C021	1-101-890-21	CERAMIC	75PF	5%	50V
C022	1-101-888-00	CERAMIC	68PF	5%	50V
C023	1-101-880-00	CERAMIC	47PF	5%	50V
C024	1-101-004-00	CERAMIC	0.01MF		50V
C025	1-101-006-21	CERAMIC	0.047MF		50V
C026	1-101-006-21	CERAMIC	0.047MF		50V
C027	1-123-608-00	ELECT	0.22MF	20%	50V
C028	1-123-356-00	ELECT	10MF	20%	16V
C029	1-123-356-00	ELECT	10MF	20%	16V
C030	1-102-820-00	CERAMIC	330PF	5%	50V
C031	1-102-973-00	CERAMIC	100PF		50V
C032	1-102-820-00	CERAMIC	330PF	5%	50V
C033	1-102-942-00	CERAMIC	5PF	0.5PF	50V
C034	1-102-958-00	CERAMIC	20PF	5%	50V
C035	1-102-959-00	CERAMIC	22PF	5%	50V
C038	1-101-006-21	CERAMIC	0.047MF		50V
C039	1-102-947-00	CERAMIC	10PF	5%	50V
C040	1-101-880-00	CERAMIC	47PF	5%	50V
C041	1-102-976-00	CERAMIC	180PF	5%	50V
C042	1-123-369-00	ELECT	4.7MF	20%	25V
C045	1-123-382-00	ELECT	3.3MF	20%	50V
C046	1-101-880-00	CERAMIC	47PF	5%	50V
C049	1-101-006-21	CERAMIC	0.047MF		50V
C050	1-102-980-00	CERAMIC	270PF	5%	50V
C051	1-101-005-00	CERAMIC	0.022MF		50V
C052	1-101-005-00	CERAMIC	0.022MF		50V
C053	1-101-006-21	CERAMIC	0.047MF		50V
C054	1-123-356-00	ELECT	10MF	20%	16V
C055	1-102-965-00	CERAMIC	39PF	5%	50V
C056	1-102-946-00	CERAMIC	9PF	0.5PF	50V
C057	1-102-963-00	CERAMIC	33PF	5%	50V
C058	1-101-006-21	CERAMIC	0.047MF		50V
C059	1-102-976-00	CERAMIC	180PF	5%	50V
C060	1-101-888-00	CERAMIC	68PF	5%	50V
C061	1-161-025-00	CERAMIC	0.1MF	10%	25V
C063	1-101-361-00	CERAMIC	150PF	5%	50V
C064	1-102-976-00	CERAMIC	180PF	5%	50V
C065	1-102-971-00	CERAMIC	82PF	5%	50V
C066	1-102-946-00	CERAMIC	9PF	0.5PF	50V
C067	1-102-820-00	CERAMIC	330PF	5%	50V
C068	1-102-960-00	CERAMIC	24PF	5%	50V
C073	1-101-006-21	CERAMIC	0.047MF		50V
C075	1-102-946-00	CERAMIC	9PF	0.5PF	50V
C076	1-102-947-00	CERAMIC	10PF	5%	50V
C077	1-102-119-00	CERAMIC	0.0015MF	10%	50V
C080	1-102-961-00	CERAMIC	27PF	5%	50V
C100	1-101-006-21	CERAMIC	0.047MF		50V
C101	1-102-074-00	CERAMIC	0.001MF	10%	50V
C102	1-101-004-00	CERAMIC	0.01MF		50V
C103	1-101-884-00	CERAMIC	56PF	5%	50V
C104	1-102-959-00	CERAMIC	22PF	5%	50V
C105	1-123-381-00	ELECT	2.2MF	20%	50V
C106	1-123-369-00	ELECT	4.7MF	20%	25V
C107	1-101-884-00	CERAMIC	56PF	5%	50V
C109	1-101-006-21	CERAMIC	0.047MF		50V
C110	1-123-381-00	ELECT	2.2MF	20%	50V
C111	1-123-369-00	ELECT	4.7MF	20%	25V
C112	1-123-369-00	ELECT	4.7MF	20%	25V
C114	1-101-880-00	CERAMIC	47PF	5%	50V
C115	1-101-888-00	CERAMIC	68PF	5%	50V
C116	1-101-361-00	CERAMIC	150PF	5%	50V
C117	1-102-947-00	CERAMIC	10PF	5%	50V
C118	1-123-307-00	ELECT	100MF	20%	6.3V
C119	1-101-890-21	CERAMIC	75PF	5%	50V
C120	1-101-886-21	CERAMIC	62PF	5%	50V
C121	1-101-004-00	CERAMIC	0.01MF		50V
C122	1-101-884-00	CERAMIC	56PF	5%	50V
C123	1-101-004-00	CERAMIC	0.01MF		50V
C124	1-102-959-00	CERAMIC	22PF	5%	50V
C125	1-123-356-00	ELECT	10MF	20%	16V
C126	1-102-074-00	CERAMIC	0.001MF	10%	50V
C127	1-102-074-00	CERAMIC	0.001MF	10%	50V
C128	1-101-006-21	CERAMIC	0.047MF		50V
C129	1-123-308-00	ELECT	220MF	20%	6.3V
C130	1-101-006-21	CERAMIC	0.047MF		50V
C131	1-101-006-21	CERAMIC	0.047MF		50V
C132	1-123-330-00	ELECT	22MF	20%	16V
C133	1-101-004-00	CERAMIC	0.01MF		50V

When indicating parts by reference number, please include the board name.

VI-9C

Ref.No	Part No.	Description			Remark
C135	1-102-074-00	CERAMIC	0.001MF	10%	50V
C136	1-102-966-00	CERAMIC	43PF	5%	50V
C137	1-102-074-00	CERAMIC	0.001MF	10%	50V
C139	1-102-074-00	CERAMIC	0.001MF	10%	50V
C140	1-102-127-21	CERAMIC	0.0068MF	10%	50V
C141	1-123-382-00	ELECT	3.3MF	20%	50V
C142	1-102-074-00	CERAMIC	0.001MF	10%	50V
C143	1-102-074-00	CERAMIC	0.001MF	10%	50V
C144	1-101-006-21	CERAMIC	0.047MF		50V
C145	1-123-356-00	ELECT	10MF	20%	16V
C146	1-102-815-00	CERAMIC	110PF	5%	50V
C147	1-101-004-00	CERAMIC	0.01MF		50V
C148	1-102-074-00	CERAMIC	0.001MF	10%	50V
C150	1-102-074-00	CERAMIC	0.001MF	10%	50V
C151	1-101-361-00	CERAMIC	150PF	5%	50V
C152	1-102-824-00	CERAMIC	470PF	5%	50V
C153	1-102-959-00	CERAMIC	22PF	5%	50V
C154	1-123-381-00	ELECT	2.2MF	20%	50V
C155	1-101-006-21	CERAMIC	0.047MF		50V
C156	1-101-888-00	CERAMIC	68PF	5%	50V
C157	1-101-006-21	CERAMIC	0.047MF		50V
C158	1-102-123-00	CERAMIC	0.0033MF	10%	50V
C159	1-124-239-00	ELECT	6.8MF	20%	25V
C160	1-123-330-00	ELECT	22MF	20%	16V
C161	1-102-963-00	CERAMIC	33PF	5%	50V
C162	1-101-884-00	CERAMIC	56PF	5%	50V
C163	1-102-978-00	CERAMIC	220PF	5%	50V
C164	1-102-978-00	CERAMIC	220PF	5%	50V
C172	1-101-880-00	CERAMIC	47PF	5%	50V
C200	1-101-006-21	CERAMIC	0.047MF		50V
C201	1-101-006-21	CERAMIC	0.047MF		50V
C202	1-101-004-00	CERAMIC	0.01MF		50V
C203	1-101-004-00	CERAMIC	0.01MF		50V
C204	1-101-004-00	CERAMIC	0.01MF		50V
C206	1-101-004-00	CERAMIC	0.01MF		50V
C207	1-102-074-00	CERAMIC	0.001MF	10%	50V
C208	1-102-942-00	CERAMIC	5PF	0.5PF	50V
C209	1-123-356-00	ELECT	10MF	20%	16V
C210	1-101-004-00	CERAMIC	0.01MF		50V
C211	1-102-820-00	CERAMIC	330PF	5%	50V
C212	1-101-004-00	CERAMIC	0.01MF		50V
C213	1-102-820-00	CERAMIC	330PF	5%	50V
C214	1-101-006-21	CERAMIC	0.047MF		50V
C215	1-102-820-00	CERAMIC	330PF	5%	50V
C216	1-102-947-00	CERAMIC	10PF	5%	50V
C217	1-102-966-00	CERAMIC	43PF	5%	50V
C218	1-102-074-00	CERAMIC	0.001MF	10%	50V
C219	1-102-820-00	CERAMIC	330PF	5%	50V
C220	1-102-820-00	CERAMIC	330PF	5%	50V
C221	1-101-004-00	CERAMIC	0.01MF		50V
C222	1-124-239-00	ELECT	6.8MF	20%	25V
C223	1-101-005-00	CERAMIC	0.022MF		50V
C224	1-123-369-00	ELECT	4.7MF	20%	25V

Ref.No	Part No.	Description			Remark
C225	1-123-356-00	ELECT	10MF	20%	16V
C227	1-101-004-00	CERAMIC	0.01MF		50V
C228	1-101-006-21	CERAMIC	0.047MF		50V
C229	1-123-381-00	ELECT	2.2MF	20%	50V
C230	1-123-608-00	ELECT	0.22MF	20%	50V
C231	1-101-005-00	CERAMIC	0.022MF		50V
C232	1-102-074-00	CERAMIC	0.001MF	10%	50V
C233	1-101-006-21	CERAMIC	0.047MF		50V
C234	1-123-381-00	ELECT	2.2MF	20%	50V
C235	1-102-118-00	CERAMIC	0.0012MF	10%	50V
C237	1-101-880-00	CERAMIC	47PF	5%	50V
C238	1-102-820-00	CERAMIC	330PF	5%	50V
C239	1-102-074-00	CERAMIC	0.001MF	10%	50V
C240	1-123-381-00	ELECT	2.2MF	20%	50V
C241	1-102-074-00	CERAMIC	0.001MF	10%	50V
C242	1-101-005-00	CERAMIC	0.022MF		50V
C243	1-102-962-21	CERAMIC	30PF	5%	50V
C244	1-102-976-00	CERAMIC	180PF	5%	50V
C245	1-102-118-00	CERAMIC	0.0012MF	10%	50V
C246	1-102-121-00	CERAMIC	0.0022MF	10%	50V
C249	1-102-820-00	CERAMIC	330PF	5%	50V
C250	1-123-607-00	ELECT	0.1MF	20%	50V
C251	1-123-609-00	ELECT	0.33MF	20%	50V
C252	1-102-963-00	CERAMIC	33PF	5%	50V
C253	1-102-973-00	CERAMIC	100PF		50V
C254	1-101-880-00	CERAMIC	47PF	5%	50V
C255	1-101-880-00	CERAMIC	47PF	5%	50V
C256	1-123-356-00	ELECT	10MF	20%	16V
C257	1-161-025-00	CERAMIC	0.1MF	10%	25V
C258	1-101-888-00	CERAMIC	68PF	5%	50V
C259	1-102-951-00	CERAMIC	15PF	5%	50V
C260	1-102-976-00	CERAMIC	180PF	5%	50V
C261	1-102-945-00	CERAMIC	8PF	0.5PF	50V
C262	1-101-006-21	CERAMIC	0.047MF		50V
C264	1-101-006-21	CERAMIC	0.047MF		50V
C265	1-101-004-00	CERAMIC	0.01MF		50V
C266	1-101-006-21	CERAMIC	0.047MF		50V
C267	1-101-006-21	CERAMIC	0.047MF		50V
C269	1-101-004-00	CERAMIC	0.01MF		50V
C270	1-102-074-00	CERAMIC	0.001MF	10%	50V
C271	1-101-004-00	CERAMIC	0.01MF		50V
C300	1-123-607-00	ELECT	0.1MF	20%	50V
C301	1-102-973-00	CERAMIC	100PF		50V
C302	1-123-607-00	ELECT	0.1MF	20%	50V
C303	1-102-973-00	CERAMIC	100PF		50V
C304	1-123-381-00	ELECT	2.2MF	20%	50V
C305	1-123-380-00	ELECT	1MF	20%	50V
C313	1-123-318-00	ELECT	33MF	20%	10V
C323	1-123-356-00	ELECT	10MF	20%	16V
C400	1-101-004-00	CERAMIC	0.01MF		50V
C401	1-102-361-00	CERAMIC	0.0039MF	10%	50V
C413	1-123-318-00	ELECT	33MF	20%	10V
C423	1-123-356-00	ELECT	10MF	20%	16V

When indicating parts by reference number, please include the board name.

Ref.No	Part No.	Description			Remark
C501	1-101-361-00	CERAMIC	150PF	5%	50V
C502	1-101-004-00	CERAMIC	0.01MF		50V
C601	1-161-025-00	CERAMIC	0.1MF	10%	25V
C602	1-161-023-00	CERAMIC	0.068MF	10%	25V
C700	1-124-471-00	ELECT	1000MF	20%	6.3V
C931	1-123-607-00	ELECT	0.1MF	20%	50V

CONNECTOR

Ref.No	Part No.	Description
CN002	*1-560-890-00	PIN, CONNECTOR 2P
CN003	*1-560-895-00	PIN, CONNECTOR 7P
CN004	*1-560-890-00	PIN, CONNECTOR 2P
CN006	1-561-534-00	SOCKET 21P
CN008	*1-560-893-00	PIN, CONNECTOR 5P
CN011	*1-560-896-00	PIN, CONNECTOR 8P
CN012	*1-560-893-00	PIN, CONNECTOR 5P
CN020	*1-564-187-00	PIN, CONNECTOR

COMPOSITION CIRCUIT BLOCK

Ref.No	Part No.	Description
CP001	1-232-919-11	COMPOSITION CIRCUIT BLOCK
CP003	1-232-914-11	COMPOSITION CIRCUIT BLOCK
CP004	1-232-917-11	COMPOSITION CIRCUIT BLOCK
CP005	1-232-918-11	COMPOSITION CIRCUIT BLOCK
CP006	1-232-928-11	COMPOSITION CIRCUIT BLOCK
CP007	1-232-935-11	COMPOSITION CIRCUIT BLOCK
CP008	1-232-937-11	COMPOSITION CIRCUIT BLOCK
CP011	1-232-922-11	COMPOSITION CIRCUIT BLOCK
CP012	1-232-920-11	COMPOSITION CIRCUIT BLOCK
CP013	1-232-938-11	COMPOSITION CIRCUIT BLOCK
CP014	1-232-915-11	COMPOSITION CIRCUIT BLOCK
CP015	1-232-912-11	COMPOSITION CIRCUIT BLOCK
CP016	1-232-931-11	COMPOSITION CIRCUIT BLOCK
CP017	1-232-913-11	COMPOSITION CIRCUIT BLOCK
CP018	1-232-938-11	COMPOSITION CIRCUIT BLOCK
CP019	1-232-916-11	COMPOSITION CIRCUIT BLOCK
CP020	1-232-932-11	COMPOSITION CIRCUIT BLOCK
CP021	1-232-936-11	COMPOSITION CIRCUIT BLOCK
CP022	1-232-934-11	COMPOSITION CIRCUIT BLOCK
CP100	1-232-927-11	COMPOSITION CIRCUIT BLOCK
CP101	1-232-921-11	COMPOSITION CIRCUIT BLOCK
CP301	1-217-658-11	JUMPER, ADJUSTABLE 0.22
CP401	1-217-658-11	JUMPER, ADJUSTABLE 0.22
CP501	1-217-658-11	JUMPER, ADJUSTABLE 0.22

TRIMMER

Ref.No	Part No.	Description
CV200	1-141-227-00	CAP, CERAMIC TRIMMER

DIODE

Ref.No	Part No.	Description
D001	8-719-911-19	DIODE 1SS119
D002	8-719-151-07	DIODE RD5.1E-B
D003	8-719-815-87	DIODE 1S1587
D004	8-719-815-87	DIODE 1S1587
D005	8-719-815-87	DIODE 1S1587
D006	8-719-815-87	DIODE 1S1587
D008	8-719-911-19	DIODE 1SS119
D009	8-719-911-19	DIODE 1SS119
D010	8-719-815-87	DIODE 1S1587
D102	8-719-000-12	DIODE MC931
D103	8-719-000-06	DIODE MC921
D104	8-719-815-87	DIODE 1S1587
D105	8-719-815-87	DIODE 1S1587
D106	8-719-000-12	DIODE MC931
D107	8-719-000-12	DIODE MC931
D200	8-719-100-37	DIODE RD6.2EB1
D203	8-719-000-06	DIODE MC921
D204	8-719-000-06	DIODE MC921

DELAY LINE

Ref.No	Part No.	Description
DL100	1-415-282-31	DELAY LINE
DL101	1-415-386-21	DELAY LINE, 1H (13.3MHZ)

FILTER

Ref.No	Part No.	Description
FL002	1-409-397-11	TRAP
FL100	1-235-440-11	FILTER, BAND PASS (3.7MHZ)
FL101	1-235-441-11	FILTER, BAND PASS (5.17MHZ)
FL200	1-409-408-11	C.E TRAP
FL201	1-409-396-11	REC C TRAP
FL202	1-235-437-11	BPF, PB C

IC

Ref.No	Part No.	Description
IC001	8-752-013-00	IC CX20130
IC002	8-752-013-10	IC CX20131
IC003	8-752-013-20	IC CX20132
IC004	8-759-302-94	CX22031
IC005	8-759-913-64	IC CX23064
IC006	8-759-202-68	IC CX20147
IC007	1-235-497-11	REC PILOT LPF
IC008	8-759-700-40	IC NJM4560S

COIL

Ref.No	Part No.	Description
L001	1-408-421-00	MICRO INDUCTOR 100UH
L002	1-408-413-00	MICRO INDUCTOR 22UH
L004	1-408-424-00	MICRO INDUCTOR 180UH
L005	1-408-426-00	MICRO INDUCTOR 270UH
L006	1-408-425-00	MICRO INDUCTOR 220UH
L007	1-408-419-00	MICRO INDUCTOR 68UH
L010	1-408-424-00	MICRO INDUCTOR 180UH
L012	1-408-606-21	MICRO INDUCTOR 18UH
L013	1-408-421-00	MICRO INDUCTOR 100UH
L014	1-408-422-00	MICRO INDUCTOR 120UH
L016	1-408-416-00	MICRO INDUCTOR 39UH
L017	1-408-427-00	MICRO INDUCTOR 330UH
L018	1-408-422-00	MICRO INDUCTOR 120UH
L019	1-408-423-00	MICRO INDUCTOR 150UH
L021	1-410-072-21	MICRO INDUCTOR 820UH

When indicating parts by reference number, please include the board name.

VI-9C

Ref.No	Part No.	Description	Remark
L022	1-408-421-00	MICRO INDUCTOR 100UH	
L100	1-408-397-00	MICRO INDUCTOR 1UH	
L101	1-408-397-00	MICRO INDUCTOR 1UH	
L103	1-408-418-00	MICRO INDUCTOR 56UH	
L104	1-408-420-00	MICRO INDUCTOR 82UH	
L105	1-408-418-00	MICRO INDUCTOR 56UH	
L106	1-408-421-00	MICRO INDUCTOR 100UH	
L107	1-408-419-00	MICRO INDUCTOR 68UH	
L108	1-408-413-00	MICRO INDUCTOR 22UH	
L109	1-408-408-00	MICRO INDUCTOR 8.2UH	
L110	1-408-412-00	MICRO INDUCTOR 18UH	
L111	1-408-413-00	MICRO INDUCTOR 22UH	
L112	1-408-418-00	MICRO INDUCTOR 56UH	
L113	1-408-397-00	MICRO INDUCTOR 1UH	
L114	1-408-417-00	MICRO INDUCTOR 47UH	
L115	1-408-417-00	MICRO INDUCTOR 47UH	
L116	1-408-414-00	MICRO INDUCTOR 27UH	
L200	1-408-424-00	MICRO INDUCTOR 180UH	
L201	1-408-413-00	MICRO INDUCTOR 22UH	
L203	1-408-422-00	MICRO INDUCTOR 120UH	
L204	1-410-072-21	MICRO INDUCTOR 820UH	
L205	1-408-422-00	MICRO INDUCTOR 120UH	
L206	1-408-425-00	MICRO INDUCTOR 220UH	
L207	1-408-420-00	MICRO INDUCTOR 82UH	
L208	1-408-407-00	MICRO INDUCTOR 6.8UH	
L209	1-408-427-00	MICRO INDUCTOR 330UH	
L400	1-407-177-XX	MICRO INDUCTOR 470UH	
L501	1-408-425-00	MICRO INDUCTOR 220UH	
L931	1-408-421-00	MICRO INDUCTOR 100UH	
L932	1-408-421-00	MICRO INDUCTOR 100UH	
		VARIABLE COIL	
LV001	1-409-397-11	COIL	
LV100	1-408-512-00	COIL (VARIABLE)	
		IC LINK	
PS200⚠	1-532-679-00	LINK, IC ICP-N15	
		TRANSISTOR	
Q002	8-729-900-36	TRANSISTOR DTC124ES	
Q003	8-729-117-54	TRANSISTOR 2SA1175	
Q004	8-729-117-54	TRANSISTOR 2SA1175	
Q007	8-729-117-54	TRANSISTOR 2SA1175	
Q008	8-729-384-48	TRANSISTOR 2SA844	
Q009	8-729-245-83	TRANSISTOR 2SC2458	
Q010	8-729-245-83	TRANSISTOR 2SC2458	
Q011	8-729-900-36	TRANSISTOR DTC124ES	
Q012	8-729-117-54	TRANSISTOR 2SA1175	
Q013	8-729-117-54	TRANSISTOR 2SA1175	
Q014	8-729-900-36	TRANSISTOR DTC124ES	
Q015	8-729-900-36	TRANSISTOR DTC124ES	
Q016	8-729-245-83	TRANSISTOR 2SC2458	
Q017	8-729-900-36	TRANSISTOR DTC124ES	

Ref.No	Part No.	Description				Remark
Q021	8-729-900-89	TRANSISTOR DTC144ES				
Q100	8-729-900-36	TRANSISTOR DTC124ES				
Q101	8-729-900-36	TRANSISTOR DTC124ES				
Q102	8-729-117-54	TRANSISTOR 2SA1175				
Q103	8-729-245-83	TRANSISTOR 2SC2458				
Q104	8-729-245-83	TRANSISTOR 2SC2458				
Q105	8-729-245-83	TRANSISTOR 2SC2458				
Q106	8-729-245-83	TRANSISTOR 2SC2458				
Q107	8-729-900-36	TRANSISTOR DTC124ES				
Q108	8-729-900-36	TRANSISTOR DTC124ES				
Q109	8-729-900-36	TRANSISTOR DTC124ES				
Q110	8-729-245-83	TRANSISTOR 2SC2458				
Q111	8-729-900-36	TRANSISTOR DTC124ES				
Q200	8-729-245-83	TRANSISTOR 2SC2458				
Q201	8-729-900-36	TRANSISTOR DTC124ES				
Q203	8-729-603-50	TRANSISTOR 2SC403SP				
Q204	8-729-603-50	TRANSISTOR 2SC403SP				
Q205	8-729-900-89	TRANSISTOR DTC144ES				
Q206	8-729-804-08	TRANSISTOR 2SA1319-S				
Q207	8-729-900-36	TRANSISTOR DTC124ES				
Q208	8-729-245-83	TRANSISTOR 2SC2458				
Q209	8-729-245-83	TRANSISTOR 2SC2458				
Q212	8-729-245-83	TRANSISTOR 2SC2458				
Q213	8-729-900-36	TRANSISTOR DTC124ES				
Q214	8-729-900-36	TRANSISTOR DTC124ES				
Q215	8-729-245-83	TRANSISTOR 2SC2458				
Q216	8-729-245-83	TRANSISTOR 2SC2458				
Q217	8-729-245-83	TRANSISTOR 2SC2458				
Q218	8-729-900-61	TRANSISTOR DTA114ES				
Q220	8-729-245-83	TRANSISTOR 2SC2458				
Q258	8-729-900-36	TRANSISTOR DTC124ES				
Q300	8-729-900-36	TRANSISTOR DTC124ES				
Q401	8-729-900-89	TRANSISTOR DTC144ES				
Q402	8-729-178-54	TRANSISTOR 2SC2785-F				
		RESISTOR				
R001	1-247-881-00	CARBON	120K	5%	1/6W	
R002	1-247-895-00	CARBON	470K	5%	1/6W	
R003	1-247-857-00	CARBON	12K	5%	1/6W	
R004	1-247-859-00	CARBON	15K	5%	1/6W	
R005	1-249-437-11	CARBON	47K	5%	1/6W	
R006	1-249-437-11	CARBON	47K	5%	1/6W	
R007	1-247-831-00	CARBON	1K	5%	1/6W	
R008	1-247-891-00	CARBON	330K	5%	1/6W	
R010	1-247-831-00	CARBON	1K	5%	1/6W	
R011	1-247-879-00	CARBON	100K	5%	1/6W	
R012	1-247-875-00	CARBON	68K	5%	1/6W	
R013	1-247-831-00	CARBON	1K	5%	1/6W	
R014	1-249-437-11	CARBON	47K	5%	1/6W	
R015	1-249-437-11	CARBON	47K	5%	1/6W	
R016	1-249-437-11	CARBON	47K	5%	1/6W	
R017	1-247-873-00	CARBON	56K	5%	1/6W	
R018	1-249-425-11	CARBON	4.7K	5%	1/6W	

The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

Ref.No	Part No.	Description				Remark
R019	1-249-425-11	CARBON	4.7K	5%	1/6W	
R020	1-247-831-00	CARBON	1K	5%	1/6W	
R021	1-247-823-00	CARBON	470	5%	1/6W	
R022	1-247-863-00	CARBON	22K	5%	1/6W	
R023	1-247-823-00	CARBON	470	5%	1/6W	
R024	1-249-437-11	CARBON	47K	5%	1/6W	
R025	1-249-437-11	CARBON	47K	5%	1/6W	
R026	1-249-437-11	CARBON	47K	5%	1/6W	
R027	1-249-437-11	CARBON	47K	5%	1/6W	
R029	1-247-839-00	CARBON	2.2K	5%	1/6W	
R030	1-247-841-00	CARBON	2.7K	5%	1/6W	
R031	1-247-839-00	CARBON	2.2K	5%	1/6W	
R032	1-247-845-00	CARBON	3.9K	5%	1/6W	
R033	1-247-883-00	CARBON	150K	5%	1/6W	
R037	1-247-853-00	CARBON	8.2K	5%	1/6W	
R040	1-247-823-00	CARBON	470	5%	1/6W	
R042	1-247-831-00	CARBON	1K	5%	1/6W	
R043	1-247-863-00	CARBON	22K	5%	1/6W	
R045	1-247-831-00	CARBON	1K	5%	1/6W	
R050	1-247-839-00	CARBON	2.2K	5%	1/6W	
R051	1-247-839-00	CARBON	2.2K	5%	1/6W	
R052	1-247-841-00	CARBON	2.7K	5%	1/6W	
R054	1-247-837-00	CARBON	1.8K	5%	1/6W	
R055	1-247-804-00	CARBON	75	5%	1/6W	
R056	1-247-797-00	CARBON	39	5%	1/6W	
R057	1-247-797-00	CARBON	39	5%	1/6W	
R058	1-249-414-11	CARBON	560	5%	1/6W	
R059	1-247-845-00	CARBON	3.9K	5%	1/6W	
R060	1-247-821-00	CARBON	390	5%	1/6W	
R062	1-249-414-11	CARBON	560	5%	1/6W	
R063	1-247-817-00	CARBON	270	5%	1/6W	
R064	1-247-863-00	CARBON	22K	5%	1/6W	
R065	1-247-823-00	CARBON	470	5%	1/6W	
R066	1-247-833-00	CARBON	1.2K	5%	1/6W	
R067	1-247-805-00	CARBON	82	5%	1/6W	
R068	1-247-839-00	CARBON	2.2K	5%	1/6W	
R069	1-247-827-00	CARBON	680	5%	1/6W	
R070	1-247-883-00	CARBON	150K	5%	1/6W	
R072	1-247-815-00	CARBON	220	5%	1/6W	
R073	1-249-425-11	CARBON	4.7K	5%	1/6W	
R074	1-249-425-11	CARBON	4.7K	5%	1/6W	
R075	1-247-843-00	CARBON	3.3K	5%	1/6W	
R077	1-249-414-11	CARBON	560	5%	1/6W	
R079	1-249-419-11	CARBON	1.5K	5%	1/6W	
R080	1-247-863-00	CARBON	22K	5%	1/6W	
R083	1-247-817-00	CARBON	270	5%	1/6W	
R084	1-247-815-00	CARBON	220	5%	1/6W	
R101	1-247-809-00	CARBON	120	5%	1/6W	
R102	1-247-857-00	CARBON	12K	5%	1/6W	
R103	1-247-863-00	CARBON	22K	5%	1/6W	
R104	1-247-863-00	CARBON	22K	5%	1/6W	
R105	1-247-895-00	CARBON	470K	5%	1/6W	
R106	1-247-903-00	CARBON	1M	5%	1/6W	

Ref.No	Part No.	Description				Remark
R107	1-247-807-00	CARBON	100	5%	1/6W	
R108	1-249-429-11	CARBON	10K	5%	1/6W	
R110	1-247-869-00	CARBON	39K	5%	1/6W	
R111	1-247-859-00	CARBON	15K	5%	1/6W	
R113	1-247-833-00	CARBON	1.2K	5%	1/6W	
R114	1-249-425-11	CARBON	4.7K	5%	1/6W	
R122	1-247-829-00	CARBON	820	5%	1/6W	
R125	1-247-833-00	CARBON	1.2K	5%	1/6W	
R131	1-247-831-00	CARBON	1K	5%	1/6W	
R132	1-247-823-00	CARBON	470	5%	1/6W	
R133	1-247-831-00	CARBON	1K	5%	1/6W	
R134	1-247-821-00	CARBON	390	5%	1/6W	
R135	1-247-821-00	CARBON	390	5%	1/6W	
R136	1-247-809-00	CARBON	120	5%	1/6W	
R137	1-247-817-00	CARBON	270	5%	1/6W	
R138	1-249-437-11	CARBON	47K	5%	1/6W	
R139	1-249-437-11	CARBON	47K	5%	1/6W	
R140	1-247-831-00	CARBON	1K	5%	1/6W	
R141	1-249-434-11	CARBON	27K	5%	1/6W	
R142	1-247-859-00	CARBON	15K	5%	1/6W	
R143	1-247-807-00	CARBON	100	5%	1/6W	
R144	1-247-791-00	CARBON	22	5%	1/6W	
R145	1-247-839-00	CARBON	2.2K	5%	1/6W	
R146	1-247-831-00	CARBON	1K	5%	1/6W	
R147	1-247-831-00	CARBON	1K	5%	1/6W	
R151	1-249-419-11	CARBON	1.5K	5%	1/6W	
R155	1-249-437-11	CARBON	47K	5%	1/6W	
R156	1-247-875-00	CARBON	68K	5%	1/6W	
R159	1-249-414-11	CARBON	560	5%	1/6W	
R161	1-247-823-00	CARBON	470	5%	1/6W	
R164	1-247-827-00	CARBON	680	5%	1/6W	
R165	1-249-425-11	CARBON	4.7K	5%	1/6W	
R168	1-249-425-11	CARBON	4.7K	5%	1/6W	
R173	1-249-419-11	CARBON	1.5K	5%	1/6W	
R174	1-247-849-00	CARBON	5.6K	5%	1/6W	
R175	1-247-827-00	CARBON	680	5%	1/6W	
R176	1-247-827-00	CARBON	680	5%	1/6W	
R178	1-247-831-00	CARBON	1K	5%	1/6W	
R179	1-247-895-00	CARBON	470K	5%	1/6W	
R180	1-249-434-11	CARBON	27K	5%	1/6W	
R181	1-247-831-00	CARBON	1K	5%	1/6W	
R182	1-249-429-11	CARBON	10K	5%	1/6W	
R183	1-249-432-11	CARBON	18K	5%	1/6W	
R184	1-247-879-00	CARBON	100K	5%	1/6W	
R185	1-247-841-00	CARBON	2.7K	5%	1/6W	
R186	1-247-859-00	CARBON	15K	5%	1/6W	
R187	1-247-867-00	CARBON	33K	5%	1/6W	
R190	1-249-432-11	CARBON	18K	5%	1/6W	
R200	1-247-867-00	CARBON	33K	5%	1/6W	
R201	1-247-823-00	CARBON	470	5%	1/6W	
R203	1-247-841-00	CARBON	2.7K	5%	1/6W	
R209	1-247-831-00	CARBON	1K	5%	1/6W	
R218	1-247-807-00	CARBON	100	5%	1/6W	

When indicating parts by reference number, please include the board name.

VI-9C

Ref.No	Part No.	Description				Remark
R219	1-247-839-00	CARBON	2.2K	5%	1/6W	
R220	1-247-831-00	CARBON	1K	5%	1/6W	
R221	1-247-831-00	CARBON	1K	5%	1/6W	
R222	1-247-859-00	CARBON	15K	5%	1/6W	
R223	1-247-827-00	CARBON	680	5%	1/6W	
R224	1-247-859-00	CARBON	15K	5%	1/6W	
R225	1-249-425-11	CARBON	4.7K	5%	1/6W	
R226	1-247-863-00	CARBON	22K	5%	1/6W	
R227	1-247-839-00	CARBON	2.2K	5%	1/6W	
R232	1-247-863-00	CARBON	22K	5%	1/6W	
R233	1-247-879-00	CARBON	100K	5%	1/6W	
R234	1-247-851-00	CARBON	6.8K	5%	1/6W	
R235	1-247-839-00	CARBON	2.2K	5%	1/6W	
R236	1-249-437-11	CARBON	47K	5%	1/6W	
R237	1-249-437-11	CARBON	47K	5%	1/6W	
R238	1-249-425-11	CARBON	4.7K	5%	1/6W	
R239	1-247-831-00	CARBON	1K	5%	1/6W	
R240	1-249-425-11	CARBON	4.7K	5%	1/6W	
R248	1-247-885-00	CARBON	180K	5%	1/6W	
R251	1-249-429-11	CARBON	10K	5%	1/6W	
R253	1-249-425-11	CARBON	4.7K	5%	1/6W	
R254	1-249-437-11	CARBON	47K	5%	1/6W	
R261	1-247-831-00	CARBON	1K	5%	1/6W	
R262	1-247-841-00	CARBON	2.7K	5%	1/6W	
R264	1-247-831-00	CARBON	1K	5%	1/6W	
R265	1-247-823-00	CARBON	470	5%	1/6W	
R266	1-247-807-00	CARBON	100	5%	1/6W	
R267	1-247-827-00	CARBON	680	5%	1/6W	
R268	1-247-867-00	CARBON	33K	5%	1/6W	
R269	1-247-863-00	CARBON	22K	5%	1/6W	
R270	1-247-831-00	CARBON	1K	5%	1/6W	
R271	1-249-425-11	CARBON	4.7K	5%	1/6W	
R272	1-247-849-00	CARBON	5.6K	5%	1/6W	
R273	1-247-867-00	CARBON	33K	5%	1/6W	
R274	1-249-425-11	CARBON	4.7K	5%	1/6W	
R277	1-249-437-11	CARBON	47K	5%	1/6W	
R280	1-247-829-00	CARBON	820	5%	1/6W	
R282	1-247-863-00	CARBON	22K	5%	1/6W	
R284	1-247-831-00	CARBON	1K	5%	1/6W	
R285	1-247-841-00	CARBON	2.7K	5%	1/6W	
R286	1-247-815-00	CARBON	220	5%	1/6W	
R287	1-247-831-00	CARBON	1K	5%	1/6W	
R288	1-247-831-00	CARBON	1K	5%	1/6W	
R289	1-247-831-00	CARBON	1K	5%	1/6W	
R290	1-247-840-00	CARBON	2.4K	5%	1/6W	
R292	1-249-425-11	CARBON	4.7K	5%	1/6W	
R293	1-247-831-00	CARBON	1K	5%	1/6W	
R300	1-247-887-00	CARBON	220K	5%	1/6W	
R301	1-249-437-11	CARBON	47K	5%	1/6W	
R302	1-249-437-11	CARBON	47K	5%	1/6W	
R303	1-247-887-00	CARBON	220K	5%	1/6W	
R304	1-249-437-11	CARBON	47K	5%	1/6W	
R305	1-249-437-11	CARBON	47K	5%	1/6W	

Ref.No	Part No.	Description				Remark
R306	1-247-827-00	CARBON	680	5%	1/6W	
R307	1-247-827-00	CARBON	680	5%	1/6W	
R309	1-247-783-00	CARBON	10	5%	1/6W	
R310	1-247-831-00	CARBON	1K	5%	1/6W	
R311 ⚠	1-247-831-00	CARBON	1K	5%	1/6W	
R312	1-247-873-00	CARBON	56K	5%	1/6W	
R360	1-249-437-11	CARBON	47K	5%	1/6W	
R382	1-247-863-00	CARBON	22K	5%	1/6W	
R400	1-247-831-00	CARBON	1K	5%	1/6W	
R401	1-249-419-11	CARBON	1.5K	5%	1/6W	
R402	1-249-429-11	CARBON	10K	5%	1/6W	
R403	1-247-803-00	CARBON	68	5%	1/6W	
R460	1-249-437-11	CARBON	47K	5%	1/6W	
R501	1-247-831-00	CARBON	1K	5%	1/6W	
R600	1-247-831-00	CARBON	1K	5%	1/6W	
R601	1-249-425-11	CARBON	4.7K	5%	1/6W	
R658	1-247-830-00	CARBON	910	5%	1/6W	
R659	1-247-821-00	CARBON	390	5%	1/6W	
R900	1-249-419-11	CARBON	1.5K	5%	1/6W	
		VARIABLE RESISTOR				
RV001	1-228-995-00	RES, ADJ, CARBON 22K				
RV002	1-228-993-00	RES, ADJ, CARBON 4.7K				
RV003	1-228-995-00	RES, ADJ, CARBON 22K				
RV004	1-228-994-00	RES, ADJ, CARBON 10K				
RV005	1-228-995-00	RES, ADJ, CARBON 22K				
RV006	1-228-995-00	RES, ADJ, CARBON 22K				
RV100	1-228-995-00	RES, ADJ, CARBON 22K				
RV101	1-228-996-00	RES, ADJ, CARBON 47K				
RV102	1-228-998-00	RES, ADJ, CARBON 220K				
RV103	1-228-997-00	RES, ADJ, CARBON 100K				
RV201	1-228-745-00	RES, ADJ, CARBON 1K				
RV202	1-228-995-00	RES, ADJ, CARBON 22K				
RV203	1-228-989-00	RES, ADJ, CARBON 470				
RV204	1-228-994-00	RES, ADJ, CARBON 10K				
RV205	1-228-994-00	RES, ADJ, CARBON 10K				
RV206	1-228-995-00	RES, ADJ, CARBON 22K				
		CRYSTAL				
X100	1-567-442-11	VIBRATOR, CRYSTAL				
X200	1-567-146-11	VIBRATOR, CRYSTAL				
X201	1-567-345-11	VIBRATOR, CRYSTAL				

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The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

When indicating pats by reference number, plase include the board name.

Ref.No	Part No.	Description	Remark
		MISCELLANEOUS	
		*************	
	A-7090-029-A	M-SW ASSY	
	⚠1-464-471-00	BOOSTER MIXER, RF MODULATOR (RFU-831) (AEP, E MODEL)	
	⚠1-464-617-11	CONVERTER UNIT, DC-DC (E MODEL)	
	⚠1-534-817-XX	CORD, POWER (AEP, E MODEL)	
	1-535-535-11	CABLE, PIN	
Q301	⚠8-729-202-02	TRANSISTOR 2SB1015-Y (E MODEL)	
C901	1-161-057-00	CAP, CERAMIC 0.033MFX (E MODEL)	
M902	8-838-094-01	MOTOR, DC (DNR-5301A) (CONTROL)	
M904	⚠A-7090-030-A	MOTOR ASSY, L (LOACING)	
PM901	⚠1-454-377-11	SOLENOID, PLUNGER (BRAKE)	
S901	1-554-942-11	SWITCH, PUSH (RECOG R)	
S902	1-554-942-11	SWITCH, PUSH (RECOG R)	
T101	⚠1-448-439-11	TRANSFORMER, POWER (E MODEL)	

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Ref.No	Part No.	Description	Remark
		ACCESSORYS AND PACKING MATERIALS	
		********************************	
	A-6765-736-A	COMMANDER ASSY	
	*1-551-734-11	CORD, CONNECTION (E MODEL)	
	1-151-513-00	CABLE, COAXAL ASSY	
	1-151-513-00	CORD ASSY COAXIAL	
	1-557-851-21	CABLE, VIDEO MONITOR (E MODEL)	
	*3-689-588-42	INDIVIDUAL CARTON (E MODEL)	
	*3-689-589-01	CUSHION (UPPER)	
	*3-689-590-01	CUSHION (LOWER)	
	*3-694-484-01	DRIVER, VOLUME	
	3-701-628-00	BAG, POLYETHYLENE	
	3-701-630-00	BAG, POLYTHYLENE	
	3-760-430-71	MANUAL, INSTRUCTION (E MODEL) (ENGLISH, FRENCH, SPANISH)	
	3-760-430-81	MANUAL, INSTRUCTION (E MODE) (ARABIC)	

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EV-S700ES/UB
RMT-405

English
86C0963-1
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Sony Corporation